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Knowledge Sharing and Innovative Strategies in Organisational Collaborative Relationships: The Potential of Open Strategy

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UNIVERSITY OF
PLYMOUTH

**Knowledge sharing and innovative strategies in
organisational collaborative relationships: The potential
of open strategy**

by

Anna Wulf

A thesis submitted to the University of Plymouth

in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

Plymouth Business School

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Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

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Papers have been published and presented by the author based on the PhD work. The list of publications has been included in the next page.

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Abstract

Knowledge sharing and innovative strategies in organisational collaborative relationships: The potential of open strategy

Anna Wulf

Today's challenges presented by a rapidly changing business environment can be met by collaborative relationships between businesses. Businesses can exchange or share key resources that companies are unable to develop alone. Knowledge is one of the most important organisational resources and one which businesses can share in order to increase their competitive advantages, under the right circumstances. Networks are one form of collaborative relationship being already well known and widely researched. Business ecosystems are an even broader conception of inter-company relationships. The two research streams, network theory and business ecosystem theory, complement each other. Whilst network theory focuses on structures, business ecosystem theory introduces the potential of different roles played by individual businesses in these networks and describes collaborative relationships as comprising of Keystones, Dominators, Hub-Landlords and Niche players. However, so far no comprehensive approach has been developed to describe the different business ecosystem roles, their influences and their strategies in distinct collaborative relationships.

The aim of this research is to create a more detailed approach to the study of business ecosystems, focusing in particular on one role, the Keystone, operating in collaborative network relationships. In this study a literature review was first conducted, resulting in the development of a conceptual model. Expert interviews were used to enable the development of detailed multiple case studies, focusing on the Keystone role in distinctive collaborative relationships. The research offers a structured and detailed analysis of the Keystone role, its characteristics, strategies and knowledge sharing activities in different industrial sectors.

Findings show that Keystones in both formally structured and more informally structured networks of collaborative relationships, behaved in similar ways. Only some minor differences were identified between the investigated Keystones. The research identified specific Keystone characteristics and their actions, used to fulfil their role and their organisational and interorganisational strategies.

This thesis contributes to a greater understanding on the actions, characteristics and roles of different organisations operating within business networks and within a broader business ecosystem. Focusing on the essential role of the Keystone, the research provides a better understanding of network roles and dynamics and will facilitate improved strategic decision making for any organisation seeking to take advantage of collaborative relationships.

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List of Abbreviations

BE:	Business Ecosystem
CR:	Collaborative Relationships
EU:	European Union
RBV:	Resourced Based View
KBV:	Knowledge Based View
KS:	Knowledge Sharing
KT:	Knowledge Transfer
KM:	Knowledge Management
SM:	Strategic Management
SME:	Small and Medium sized Companies
SNA:	Social Network Analysis

List of Publications

Journal articles

Wulf, A., Butel, L. (2017). Knowledge sharing and collaborative relationships in business ecosystems and networks: A definition and a demarcation. *Industrial Management & Data Systems*, 117(7), 1407-1425.

Book chapter

Butel, L., Wulf, A. (2016). Knowledge sharing and Innovative Corporate Strategies in Business Ecosystems. *Lecture Notes in Business Information Processing (LNBIP) Springer book. Decision Support Systems VI: Decision Support Systems Addressing Sustainability & Societal Challenges*.

Conference Papers

Wulf, A., Butel L., Kolbeck, F. (2018). Keystone Strategy in collaborative relationships of networks and business ecosystems: a strategy as practice perspective. In *Proceeding Band EURAM Conference Iceland* (19.-22.06.2018).

Wulf, A., Butel, L. (2016). Knowledge sharing and Innovative Corporate Strategies in Business Ecosystems. In *Proceeding Band. ICDSST Conference Plymouth 2016* (23-25.05.2016).

Wulf, A., Butel, L. (2016). Knowledge transfer and innovative corporate strategies in organisational collaborative relationships: the potential of open strategy – a research strategy. In *Proceeding Band EURAM Doctoral Colloquium Paris* (30.05.-01.04).

Wulf, A., Butel, L. (2016). Knowledge transfer and innovative corporate strategies in organisational collaborative relationships: the potential of open strategy. In *Proceeding Band EURAM Conference Paris 2016* (01.-04.06.2016).

Wulf, A., Butel, L. (2016). Knowledge transfer and innovative corporate strategies in organisational collaborative relationships: the potential of open strategy. In *Proceeding Band Postgraduate Society Conference 2015* (23.06.2015).

Wulf, A., Butel, L. (2016). Knowledge transfer and innovative corporate strategies in organisational collaborative relationships: the potential of open strategy. In *Proceeding Band Doctoral Colloquium Plymouth Graduate School (UKPDC) Plymouth 2015* (05.06.2015).

Wulf, A. (2014): “Open Strategy - as a new and barely explored strategy tool? - What benefits and risks, advantages and disadvantages occur using open strategy approaches? In *Proceeding Band 4th PhD-Symposium for Applied Sciences in Munich MUAS*.

1. Introduction and overview

1.1 Research context

In order to face the complex challenges in today's world, companies collaborate with different suppliers, partners, customers, stakeholders and even competitors (Hamel, Doz and Prahalad, 1989) in order to share resources and gain competitive advantage. Resources critical for organisations might be only accessible beyond firm boundaries (Dyer, 1998). Therefore, resource exchange is one of the main reasons why companies collaborate (Lorenzoni and Baden-Fuller, 1995).

Knowledge is considered to be a key resource to share as it can reduce uncertainty (Matusik and Fitza, 2012), enable decision making, foster innovation and help to develop competitive advantage (Grant, 1996a; Van de Ven, 1986; Quintane et al., 2011; Marabelli and Newell, 2012). Some companies develop their strategies in collaboration with the relations they maintain (Ahuja, 2000). Different forms of collaborative relationships (CR) exist, structured in dyads, working groups, networks or business ecosystems (BE) (Wulf and Butel, 2017). Depending on the frequency of interaction and type of relations maintained, different possibilities to influence these relations evolve (Provan, Fish and Sydow, 2007). BE theory and network theory offer constructs that explain how CR are structured (Iansiti and Levien, 2004a; Rong et al., 2015) and what roles or strategies can be followed. This study aims to improve an understanding of Keystones in CR. It therefore investigates the Keystone role, what strategy it follows and how it manages knowledge in front of BE and network theory. To accomplish this, strategic management (SM) concepts are applied to BE theory and a structured exploration of the Keystone role is provided. Therefore, the research contributes to the SM research by investigating the Keystone in CR from a strategic management (SM) perspective.

1.2 Research aim and objective

The aim of this research is to generate a better understanding of the Keystone role in CR, as well as its KS and KM activities. So far, BE roles, being influenced by individuals and organisations at the

same time, have not been investigated in-depth. Therefore, the following research question have been developed as displayed in **Table 1.1**. These outlined questions are designed to understand the specifics of the Keystone role, Keystone's knowledge management (KM) and knowledge sharing (KS) and how Keystones differ in distinct CR.

Research questions	
Research aim: Understand the Keystone role and its knowledge management and knowledge sharing activities (in order to reach innovation and competitive advantage) within more formal and more informal collaborative relationships	
Research question one (RQ1)	How can Keystone role similarities within more formal and more informal collaborative relationships be described?
Research question two (RQ2)	How do Keystones manage and in particular share knowledge?
Research question three (RQ3)	How do Keystones differ in more formal and more informal collaborative relationships?

Table 1.1: Research questions for reaching research aim

Research objectives are specific steps needed to reach the research aim and answer the research questions. In order to achieve the above stated aim, the following five research objectives were developed and displayed in **Table 1.2**:

Research objectives
1.) Understand adjacent theories and concepts to business ecosystem theory that support research aim
2.) Define Keystone environment and develop a conceptual model on network dynamics and actor influence
3.) Identify components that underlie Keystone role and knowledge management in particular knowledge sharing
4.) Identify specifics that describe the Keystone role
5.) Develop and use a conceptual research framework of investigation and a structured description of the Keystone role

Table 1.2: Research objectives

1.3 Key contributions

Due to the research focus on Keystones and their specifics in CR, as well as to the novelty of a structured Keystone investigation, a comprehensive set of key contributions can be named. One

theoretical contribution of this work is the identification of overlapping themes of BE and network research. Different types of relations are described and linked to BE theory and network research, as well as findings related to the Keystone role. As BE theory is still evolving, it is not linked to existing interrelated or adjacent concepts so far. Additional to that, the study builds on the utilisation of new research techniques for investigating the Keystone role by introducing a new qualitative method to access network structures and explain the Keystone role attributes in CR. A multilevel analysis considering different levels of interaction for the Keystone requires a set of strong qualitative methods. Therefore, the study demonstrates a comprehensive qualitative data set, verified by method and data triangulation to strengthen the methodological approach.

By using a structured investigation of the Keystone role and its specifics within the environment of CR, a fine-grained understanding of the Keystone role is provided as well as the roles' KM and KS activities. To complement this, the Keystone is explored in his environment offering an insight to Keystones in distinct CR. The Keystone environment is considered to be an important prerequisite to his behaviour.

In addition, this research contributes to managerial practise by supporting managers' comprehension of network dynamics and network strategies. The Keystone role is influenced to a great extent by individual and organisational characteristics and actions, which assists managers to understand decision making of Keystones in collaborative relationships. Furthermore, the research supports managers' decision making and strategy adaption in networks or BEs.

1.4 Thesis structure

Altogether, the study contains nine chapters including introduction and conclusion chapters. All chapters are outlined in the following and finally summarised in **Figure 1.1**:

Chapter one delineates the research context, the research aim and the research questions. Building on that, the research objectives are introduced in order to reach the aim and answer the research questions. Beside key contributions the structure of the thesis is outlined.

Chapter two provides a comprehensive literature review in regards to organisations, networks and BEs. It also introduces SM aspects as well as KM and KS specifics. It also depicts main theories that support to understand the phenomenon and gives an overview of linkages between the identified concepts.

Chapter three outlines research gap and research questions.

Chapter four presents details of the research methodology. This chapter also provides the details of the research construct and the methods chosen.

Chapter five introduces the intended and actual data collection process by displaying different research stages as well as how qualitative data was processed in order to ensure generalisability and validity.

Chapter six provides the in-depth single case study description of **Case I** and **Case II**.

Chapter seven shows main findings of all three research stages and provides first insights into interrelations discovered.

Chapter eight discusses main findings in contrast to existing literature and underlines main outcomes of the study.

Chapter nine: summarises the findings of the study and links them to the research questions. Furthermore, theoretical implications and managerial implications are discussed as well as limitations outlined.

All chapters and their content are displayed in **Figure 1.1**.

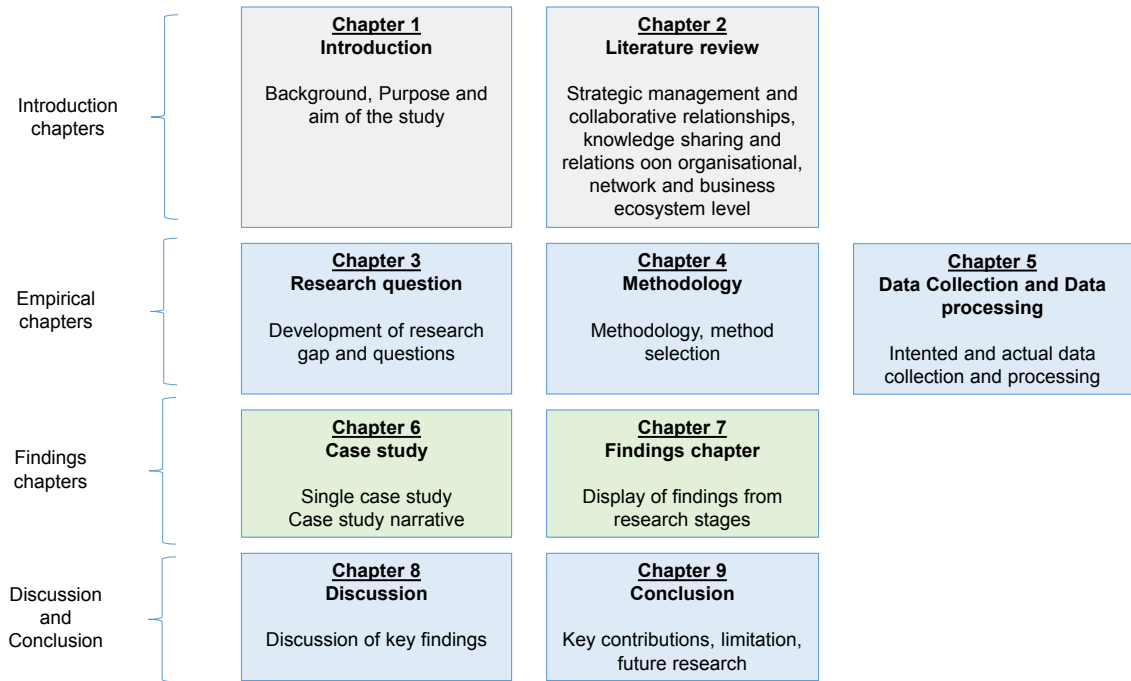


Figure 1.1: Research process and structure of the thesis

1.5 Summary

Besides outlining research context, research aim and objectives, this chapter provides an overview of key contributions and thesis structure. Building on **Figure 1.1**, the next chapter concentrates on the literature review, presenting main theoretical concepts that are important in order to reach the research aim and understand the phenomena under investigation.

2. Literature review

2.1 Introduction

In this chapter, a narrative literature review is conducted. In the following subsections, a short introduction to research is provided, then the literature review methodology is introduced. As a next step, the research topic is addressed from a narrative, phenomenological perspective undertaking a thematic review (Moustakas, 1994; Randolph, 2009; Hart, 2008). Finally, this chapter leads to the identification of the research gap in chapter three.

2.1.1 Introduction to research

In the 1990s, CR became popular and seemed to be a good possibility to partner with competitors or suppliers (Lorenzoni and Baden-Fuller, 1995) in order to access resources (Arya and Lin, 2007). Companies today are deeply interconnected with their suppliers, partners, customers, stakeholder and even competitors (Hamel, Doz and Prahalad, 1989; Shamsuzzoha et al., 2010). They operate in a network of CR. Organisations partly develop their strategies in collaboration with such relationships (Ahuja, 2000) in order to share resources, develop innovative ideas and create competitive advantage (Lorenzoni and Baden-Fuller, 1995). In the following sections the main motives for organisations to collaborate are introduced as well as a definition of CR. Furthermore, the influencing factors for competitive advantage and their characteristics on organisation level are outlined.

Due to the relevance of the above mentioned, this chapter reviews relevant literature on SM, KM, resource sharing and CR. A focus on the individual organisation is maintained acting in CR, following an open strategy of collaboration. The sections are structured by a multiple level perspective, seeing the organisation embedded in a net of CR. These CR can be interpreted from a network perspective and a broader perspective, being the BE approach. This review aims to show the importance of the single organisation and its actions within CR. Therefore, SM aspects and the organisational level are introduced first, followed by the network and the BE level with the focus on the single organisation.

All these aspects can be summarised as the phenomenon of investigation, forming a frame of reference of research (Rößl, 1990). This frame of reference is the theoretical basis for the conduction of the research and enables the development of research dimensions for the literature review. In this thesis, the frame of reference is based on the phenomenon of investigation as shown in **Figure 2.1**.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.1: Research frame of reference

(Source: adapted from Rößl, 1990)

The structure of the literature review builds on the dimensions of the frame of reference and is summarised and displayed below in **Figure 2.2**. The figure is modelled to give a guidance throughout the subsections 2.2-2.5 based on the narrative literature review approach introduced in the following.

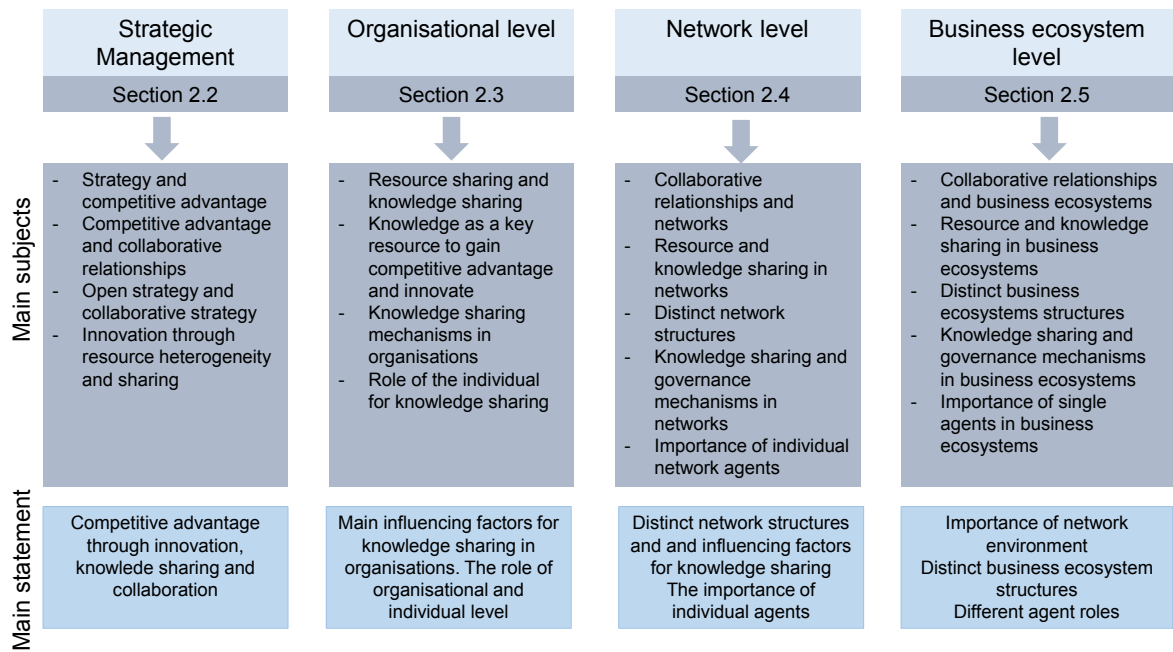


Figure 2.2: Structure of literature review chapter

2.1.2 Literature review methodology

As already outlined above, this research follows a narrative approach (Moustakas, 1994; Randolph, 2009; Hart, 2008). Narrative reviews are not systematic reviews. They are often criticised for being intransparent in methodology and methods and for being hardly replicable (Petticrew and Roberts, 2006). A narrative literature review serves the researcher to understand a subject in-depth (Jesson et al., 2011). Therefore, it is focusing on interrelations and repeating patterns within the literature that has been identified as being important based on the phenomenon under investigation (Moustakas, 1994; Randolph, 2009; Hart, 2008). Still, narrative literature reviews can be complemented by tables and figures (Denyer and Tranfield, 2011) to improve the transparency and to reduce the openness of the approach (Jesson et al., 2011). Nevertheless, the well-developed narrative needs to be in the centre of the review (Galvan and Galvan, 2017). **Table 2.1** shows the literature review methodology, its aim and its expected outcome. Building on this, a structured data collection approach is provided in **Appendix A**, the literature review data collection process. This structured data collection process enables a certain focus on relevant literature (Cronin, Ryan and Coughlan, 2007). As suitable for an

explorative, qualitative approach, this data collection process started open and got more focused throughout the process (Svejvig and Anderson, 2015). The process of search strings and keywords usage (Denyer and Tranfield, 2011) is outlined there (**Appendix A**).

Literature review methodology	Description methodology/method	Aim of methodology	Narrative/ phenomenological method as thematic review	Expected outcome
Explorative and qualitative approach of this thesis Qualitative literature review methodology	<ul style="list-style-type: none"> - Qualitative review (<i>conducted when body of literature is mainly qualitative</i> (Randolph, 2009)) - Phenomenological method and thematic review (Moustakas, 1994; Randolph, 2009) - Narrative method (<i>to highlight connections between topics that are part of frame of reference</i> (Hart, 2018)) - Structured literature data collecting process (Denyer and Tranfield, 2011; Jesson, Matheson, and Lavey, 2011; Galvan and Galvan, 2017) 	Describe the phenomenon with existing literature Show the state of the art of existing literature	<ul style="list-style-type: none"> - Bracketing (define phenomenon to be investigated as context of study/ frame of reference) - Structured data collecting process (literature around frame of reference is allocated and read) (See Appendix A) - Create understanding of context relations + identify meaningful statements (describe understanding in literature around phenomenon) - Rich description (allocate text to a rich description of the frame of reference) - Identification of gap (enable an understanding of a possible research gap (see literature review summary Table 2.5)) 	<ul style="list-style-type: none"> - Understanding of literature on frame of reference - Understanding of repetitive patterns and relations - Create a storyline of the research tradition (Greenhalgh et al., 2005) - Repetitive patterns as guidance to understand the subject - Understanding of research gap by showing less researched area in literature review narrative

Table 2.1: Literature review methodology

Building on the considerations above, the following literature review process can be identified as displayed in **Figure 2.3**. The frame of reference is the starting point for the process, building the basis for a structured data collection process (**Appendix A**) and an in-depth understanding of the subject. This results in a rich description of the subject considering the main statements and elements for the phenomenon under investigation (Denyer and Tranfield, 2011; Hart, 2018; Moustakas, 1994; Randolph, 2009). The in-depth narrative analysis of the literature allocated is conducted in the following subsections 2.2-2.5.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.3: Literature review process

(Source: adapted from Denyer and Tranfield, 2011; Jesson, Matheson, and Lavey, 2011)

2.2 Strategic management and collaborative relationships

Competitive advantage is a comprehensively discussed subject in SM (De Wit and Meyer, 2010) and is one of the main motives for collaboration (McEvily and Zaheer, 1999). It is the need to create more value than competitors (Porter, 1985). Value creation can lead to innovation which then can enable sustained competitive advantage for the firm (Porter, 1990; McEvily and Zaheer, 1999). The ability to exchange resources not available within the organisation is the basis for the building of interfirm linkages (Gulati, 1995). Resources are defined as tangible and intangible assets that organisations use for developing and implementing strategies (Peteraf, 1993; Wernerfelt, 1984; Barney, 2001). A specific set of resources can be the basis for competitive advantage when it is not imitable (Dyer and Singh, 1998; McEvily and Zaheer, 1999). Consequently, resource exchange through interfirm connections is a strong motive for collaborating with partners (Lorenzoni and Baden-Fuller, 1995). Collaborative linkages can be also named CR. Ahuja (2000, p.426) offers a definition of CR seeing them as “an interfirm collaborative linkage as a voluntary arrangement between independent

organizations to share resources”. The strategically most important resource accessed from CR is knowledge (Grant, 1996a) as it is the foundation for building up core competencies (Hamel, Doz and Prahalad, 1989) and developing innovative ideas (Grant, 1996b). Knowledge is at the basis of many firm and strategy mechanisms that will be explained further in the organisation level section.

In the following, company strategy to reach competitive advantage, openness of company strategy to collaborate with others and a first understanding of CR are outlined. As competitive advantage is influenced by the collaboration with others and the ability to share resource and knowledge, resource sharing and KS on company level and on the level of CR will be discussed in separate sections further below.

2.2.1 Strategy and competitive advantage

Companies follow strategies on different levels such as the business, corporate or the relational level (De Wit and Meyer, 2010). They collaborate to gain knowledge for decision making and for creating competitive business strategies (Hernandez et al., 2014; Jarillo, 1988) to develop innovation (Grant, 1996b; Quintane et al., 2011). CR and the resources accessed through them can help to reach a strategic fit of the company’s internal and external capabilities (De Wit and Meyer, 2010). Capabilities are what a company is able to do due to its resource and knowledge base (Eisenhardt and Martin, 2000; Sorenson, Folker and Brigham, 2008) and will be further explained in the resource-based view (RBV) section. Companies need to reach a strategic fit in order to execute their strategy successfully and react to internal abilities and external requirements on business or corporate level (De Wit and Meyer, 2010). Collaborating with interfirm connections can help to react to competitive forces (Porter, 1979; Porter, 1990) and to build up internal competencies (Hodgson, 1998). Strategies that integrate external relations need business models that are built up to enable close collaboration, mutual resource sharing and KS (Saebi and Foss, 2015).

When companies follow a more open way of strategy making with a higher inclusion of external partners this way of strategy making can be named relational strategy (De Wit and Meyer, 2010),

collaborative strategy (Clarke and Fuller, 2011), or open strategy (Whittington, Caillaet and Yakis-Douglas, 2011). Relational or open strategies mean that companies maintain many different relations, which can be for example political, economic or socio-cultural (De Wit and Meyer, 2010). By opening up to these actors, a more open or embedded organisation perspective evolves in contrast to the more discrete or more closed organisation perspective. Both are outlined in the next section.

2.2.2 Perception of firm boundaries

The question of organisations being discrete or embedded is essential for the appearance and management of the company. Organisations perceive and treat their CR and defend their competitive advantage differently (Hamel, Doz and Prahalad, 1989) depending on how embedded or discrete they perceive themselves (De Wit and Meyer, 2010). This is also influenced by the stability of the environment the company is in (Stacey, 1995). Beside managers' perceptions of firm boundaries, which itself is influenced in part by the company and its policies (Schilling and Steensma, 2002), the company's culture is influencing and affected at the same time by the degree of the organisation's embeddedness (Goh, 2002). Organisations that do not see collaborative partners as external parties tend to share ideas and strategies to a greater extend beyond their boundaries. They see their partners as being influential for developments of new and innovative ideas (Berghman et al., 2013) that can be used for new business ideas, business strategy and organisation structure (Lorenzoni and Baden-Fuller, 1995). Shared ideas can influence directions within the firm and the organisational capabilities that the company develops (Grant, 1996a; Zander and Kogut, 1995). The perception of firm boundaries also determines how deeply a company is embedded in CR. The concept of embeddedness will be explained in more detail in the network section. Companies embedded in CR consider knowledge and resources shared for strategic decisions (Gulati, Nohria and Zaheer, 2000).

The next section reflects on the concept of open strategy of firms with more open boundaries, the relevance for company strategies and the associated influence of CR.

2.2.3 Open strategy and competitive advantage

Summarising the above, when accessing openness from a SM perspective, collaborations or interfirm relationships can be seen as a more open approach to firm boundaries in order to access resources, such as knowledge, supporting to build up competitive advantage (Lorenzoni and Baden-Fuller, 1995).

Whittington, Chesbrough and Appleyard (2011) for example call the openness of company boundaries open strategy. They refer not only to open organisation structures such as strategic alliances or networks, but see openness also as a tool for knowledge creation. Open strategy as a term developed from open innovation originally coming from a marketing background (Chesbrough and Appleyard, 2007). Open strategy describes internal or external inclusion of actors, within strategy formulation or strategy implementation, in order to create innovative marketing strategies (Ritter and Gemünden, 2004). Additional value creation, technology development and product improvement are potential benefits of the approach (Gast and Zanini, 2010). The core idea is knowledge creation and openness as a strategy tool in order to reach innovative functional strategies (Sniukas, 2010).

Openness in terms of collaboration between companies and certain stakeholders is not new (McKiernan, 1997). Throughout history the first attempt to expand company boundaries was by including external entities on a contractual basis for production purposes. These outsourcing practises soon developed into the inclusion of competitors as strategic alliances or by including companies along the value chain (Jarillo, 1988). Today, open organisational structures, as more permeable boundaries, are for example strategic alliances, partnerships, coalitions, franchises and all kind of network organisations (Smith Ring and Van de Ven, 1992). Even though the open strategy concept had been linked by Whittington, Caillaet and Yakis-Douglas (2011) to SM considerations, the understanding of openness in strategy making has not been further developed so far.

To better understand a more open approach to strategy development, existing theoretical concepts of company collaborations need to be explored as they are approaches to strategy openness. In order to develop the concept of open strategy further, this thesis seeks to understand which companies are able

to use collaborative relations in distinct contexts to access resources such as knowledge and are therefore able to create innovative ideas. As open strategy can be seen as openness to firm boundaries, the concept of CR will be introduced further in the next section.

2.2.4 Collaborative relationships for resource sharing

Being embedded in different kind of CR in order to gain competitive advantage not only requires a strategic approach to access resources and knowledge, it also requires an understanding of what collaborative relations are. Additional to the short definition introduced above by Ahuja (2000), seeing interfirm linkages as rather open arrangement for resource sharing, Arya and Lin (2007) define collaborations as being organisations that are embedded into social networks for the sharing of resources. Others refer also to the business perspective and define CR as interfirm ties (Gulati, Nohria and Zaheer, 2000) or ‘formal and informal arrangements of firms’ (Zheng, Zhang and Du, 2001, p.1039).

Today, there are many different forms of CR with horizontal and vertical (Stuart, 1998), directly and indirectly related actors (Ahuja, 2000; Gulati and Gargiulo, 1999). Organised in contractual and non-contractual arrangements or as condition-setting parties without any contractual base (Gulati, Nohria and Zaheer, 2000; De Wit and Meyer, 2010). Some authors see interorganisational relations as long-term relations in which organisations keep control over resources and mutually decide about the exchange without focusing on contractual foundations (Brass et al., 2004). Suppliers, customers, competitors and organisations can be agents within these alliances (Ebers, 1997; Brass et al., 2004). Powell (1990) suggests that hierarchies and markets need to be considered when looking at collaborations and contracts can provide components of hierarchy and domination (Stinchcombe, 1985). Consequently, CR can be shaped by formal and informal relationships following distinct relationship characteristics. Depending on the formality of the relationship and the stability of the environment the company is in (Stacey, 1995) relationships can be either competitive, cooperative or collaborative. Collaboration means that at least two entities work together to reach a common goal

(Martinez-Moyano, 2006; Chew, 2013), whereas cooperation means that mutual benefits exist that do not need to follow the same aim (Kohn, 1992). Competition is based on similar resource bases in similar markets (De Wit and Meyer, 2010). All these distinct relations create interdependencies (Trkman and Desouza, 2012) between organisations acting in CR that require a certain alignment to each other (Madhavan, Gnyawali and He, 2004).

Summarising the above, CR in this work are seen as informal and formal relationships based on direct and indirect relations. They are partnerships, shaped by distinct types of relations all structured in a web of ties forming different network structures. Companies aware of these differences can decide strategically about the network arrangements they are in (Jarillo, 1988). There can be strategic benefits from improving not only one relationship but the whole network of relationships. In order to understand company strategies in networks, it is important to understand the company, its collaborative relations and the environment it is embedded in (Gulati, Nohria and Zaheer, 2000). Competitive advantage can be reached when knowledge is accessed and combined to innovative ideas (Grant, 1996b). The subsequent section discusses innovation as a possible source for competitive advantage in CR.

2.2.5 Innovation in collaborative relationships

As already described above, the ability to gain and share knowledge is directly linked to the creation of innovation and the reach of competitive advantage (Grant, 1996b). KS and knowledge transfer (KT) for innovation are frequently used in technological terms. Van de Ven (1986) stated it to be surprising that innovation is termed so narrowly and often related to technical issues instead to corporate or business level issues. Since then, business model innovation developed (Massa and Tucci, 2013) being related to business strategy and product development. Innovation does not have to be related to a technological or production background but can be simply ‘development and implementation of new ideas’ (Van de Ven, 1986, p.590). Innovation can be seen as part of an innovation process, such as innovation creation and implementation (Lendel and Varmus, 2011)

while there is a long development from a creative idea to an implementation (Klein and Sorra, 1996). Innovation can be disruptive or gradual (Rao, Angelov and Nov, 2006) or incremental or radical (Henderson and Clark, 1990) depending on completely new knowledge or specific knowledge needs. Independently from that, KS and KM are at the centre of innovation development (Forcadell and Guadamillas, 2002).

CR can support new knowledge creation and collaborative innovation (McEvily and Zaheer, 1999). Nonaka (1994) believes as well that innovative content can create a stream of information and knowledge that might raise chances for the whole organisation. A firm's innovation capability plays a major role for competitive advantage and the management of innovation is an essential task for general and top managers (Van de Ven, 1986; Aboelmaged, 2012; Martín-de Castro et al., 2011).

Accessing new knowledge in CR and relating it to strategic issues consequently is a great potential for the development of innovative strategies. Still, the question of how companies can innovate through collaboration without losing their competitive position remains unanswered.

Barney (1991) shaped the idea of heterogeneity of resources being the basis for idiosyncratic resources in every single firm (Helfat and Peteraf, 2003). Using their resources strategically in CR can enable firms to innovate by combining new sets of resources (Teece, 2000; Kogut and Zander, 1992). Thus, maintaining CR can enhance innovation (Mc Evily and Zaheer, 1999; Gulati, Nohria and Zaheer, 2000; Eisenhardt and Martin, 2000; Cohen and Levinthal, 1990). Greater variety of knowledge 'offers greater possibilities of new combinations of knowledge' (Shafique, 2013, p.78-79) and development of innovative ideas for competitive advantage (Moore, 1998). Researchers found that firms with superior KS mechanisms are able to create innovations better than firms with less well developed mechanisms (Dyer and Nobeoka, 2000). Consequently, resource and KS on an organisational level needs to be understood first in order to understand how knowledge is shared and used strategically on the level of CR.

2.3 Organisation level

After having outlined main interrelations of strategy, CR, KS and innovation, this section describes resource sharing and KS on organisational level in more detail. To improve the understanding of different KS mechanisms, the ability of the organisation to share resources such as knowledge is aimed to be deduced. Through the understanding of the mechanisms on organisational level a basis for the network level is created.

2.3.1 Resource based view

As pointed out above, the RBV emphasises the importance of knowledge as a resource. Here, the potential of organisations acting in CR to gain knowledge and build up competitive advantage to develop innovative strategies is outlined.

As mentioned before, resources are either tangible or intangible (Peteraf, 1993; Wernerfelt, 1984; Barney, 2001). Tangible assets are defined for example as being financial assets, machines, and buildings (Edvinsson and Sullivan, 1996). Intangible assets are soft skills such as human capital, organisations culture and for example knowledge (Allee, 2008; Hall, 1992). Assets represent a major source of the company's competitive success (Helfat and Peteraf, 2003).

Interfirm connections may form new intangible resources (Dyer and Singh, 1998) and firms that are able to combine resources in unique ways can gain competitive advantage. The RBV explains resource dependency, the development of core competencies and the importance of reaching competitive advantage (Barney, 1991). Being part of competence-based theories (Nelson and Winter, 1982; Tallman, 2003) the RBV outlines the role of routines and skills to understand processes of economic change (Hodgson 1998) and the building of different capabilities (Grant, 1996a). As KS is an important foundation to develop up new capabilities (Grant, 1996a) the next section outlines the knowledge-based view (KBV).

2.3.2 Knowledge-based view

The KBV emerged out of the RBV and assumes that companies seek knowledge as key resource (Grant and Baden-Fuller, 2004) in order to build up new resources (Eisenhardt and Martin, 2000) or to improve strategic decision making (Hernandez et al., 2014). Firms therefore compete on the basis of knowledge and KM (Leonard, 1998). Chandler (1977), Penrose (1959), Nelson and Winter (1982) and Teece (2000) for example see the firm as being built out of knowledge. Furthermore, knowledge as a resource plays a vital role in CR (Uzzi, 1997) due to resource heterogeneity (Helfat and Peteraf, 2003) between agents. Consequently, knowledge is essential for the organisational and CR level. Knowledge is a “fluid mix of framed experience, values, contextual information, and expert insight” (Davenport and Prusak, 1998, p.8). This definition shows the complexity of knowledge as a framework for new experiences. In order to meet that complexity, three models introduced by Liu et al. (2014) are outlined in the following to structure the understanding of KBV as a concept. The authors introduced the tacit-explicit knowledge conversion model, the spectrum focused model referring to activities of exploration and exploitation and the knowledge stages model including knowledge creation, sharing and application. Under the consideration that knowledge is an important resource to be exchanged between collaborative agents, its distinct aspects such as knowledge as a resource, knowledge type and conversion, knowledge activities and KM stages, are introduced below.

2.3.2.1 Knowledge as a resource

Knowledge as a resource is defined quite distinctly by researchers. Zack (1999) sees knowledge as value of accumulated information, which is shaped through experience, communication and interaction. Knowledge is constantly manipulated by the process of ‘simultaneously knowing and acting’ (Zack, 1999, p.46). Teece (2000) defines knowledge as being not about data and facts in the first place but about the context the knowledge is placed in. Kodama (2007) as well sees knowledge to be rather context specific than content related. Van den Berg (2013, p.164) even interprets knowledge as being a ‘meta-resource’ with a value and meaning to all other resources of the company.

Even though knowledge is interpreted distinctly, differing types of knowledge can be useful for different situations and contexts.

2.3.2.2 Types of knowledge

In order to correctly distinguish between different terms in KBV research, it is essential to differ between data, information and different types of knowledge. Ackoff (1989) outlined that data serves information, which in turn serves the development of knowledge leading to understanding and finally to wisdom. Wisdom and its meaning are not investigated here, but the link between data, information and knowledge and the distinction between the terms is essential for understanding knowledge development (Rowley, 2007).

Zack (1999, p.46) defines data as being ‘observations or facts out of context’ which are not particularly meaningful without a certain context. Information in turn refers dominantly to facts and data which is transferable through simple interchange and communication without losing the meaning of it (Kogut and Zander, 1992; Szulanski, 1996). Information assists knowledge but is not knowledge itself (Teece, 2000). Information can be accumulated to knowledge and requires experience, interaction and communication for that process (Zack, 1999; Dretske, 1983). This is supported by the work of Zhong and Ohsuga (1996a, 1996b) stating that information put into a certain context can help to develop knowledge. Knowledge can also be considered as know-how, or knowing about, being accumulated skills as the basis for certain competence in a field (Ahuja, 2000; Grant, 1996b).

In order to successfully accumulate information or knowledge, its transferability needs to be considered. Here, two types of knowledge are of particular importance, named codified or non-codified knowledge or tacit and explicit knowledge (Nonaka, 1994; Dyer and Hatch, 2006). Researchers hold a constant debate on if the terms codified and tacit can be used interchangeably (Johnson, Lorenz and Lundvall, 2002; Archer-Brown and Kietzmann, 2018). Tacit knowledge is seen as “difficult to articulate, developed from direct experience and action, and usually shared through highly interactive conversation, storytelling and shared experience. In contrast, explicit knowledge is

more precisely and formally articulated, although removed from the original context of creation or use” (Zack, 1999, p.46).

Tacit knowledge is often specialised knowledge as it resides in individuals (Nonaka, 1994) and individuals need to specialise due to cognitive constraints of the human brain (Grant, 1996a). Consequently, it cannot be accessed or combined very easily (Grant, 1996b). Specialised knowledge is idiosyncratic knowledge only understandable in a certain context and in a certain environment (Grant, 1996b; Jensen and Meckling, 1992). As explicit knowledge is uncoded knowledge (Zack, 1999), it can be part of specialised knowledge as well but is more easily transferrable (Liu et al., 2014). Non-specialised knowledge in turn plays a vital role in surroundings where no further specialisation is required but additional and new general knowledge (Dyer and Nobeoka, 2000). This knowledge is not specialised on products but driven by good ideas or creativity and will only be detected or adapted by mutual learning mechanisms (Huber, 1991; Lorenzoni and Baden-Fuller, 1995; Burt, 2000). Specialised knowledge and the variety of non-specialised knowledge are at the basis for interfirm collaboration in order to share distinct resources and enable new knowledge creation, application and the development of innovative ideas (Leonard-Barton, 1995; Dyer and Nobeoka, 2000; Ahuja, 2000; Kodama, 2007).

In this work, information is considered to serve knowledge. Additionally, all types of knowledge that can be shared will be taken into account as only little is known about what type of knowledge is exchanged in what way by agents in CR following a certain strategic interest. Therefore it is necessary to follow an exploratory approach to knowledge in this research. All the above considerations influence the knowledge creation and sharing process, which can be seen as a process of ongoing activities of knowledge exploration and exploitation.

2.3.2.3 Knowledge exploration and exploitation

When KM is seen as a process (Zack, 1999) and shaped by ongoing activities it can be divided into knowledge exploitation and exploration (Liu et al., 2014). Knowledge exploration can be linked to

knowledge generation and knowledge exploitation to knowledge application (March, 1991; Spender, 1994; Grant and Baden-Fuller, 2004). Whereas knowledge exploration requires the detection of new and creative knowledge associated to higher uncertainty and risk, knowledge exploitation aims to specialise and deepen existing knowledge towards efficiency and productivity (March, 1991). In order to explore and exploit knowledge, organisations need to identify their existing knowledge bases to build on it. For these mechanisms a learning organisation is required (Teece, Pisano and Shuen, 1997). Especially knowledge exploitation of in-depth knowledge requires strong learning mechanisms (Berghman et al., 2013). Also, the abilities of a learning organisation are essential for knowledge internalisation as it requires to match old knowledge to new knowledge (Nonaka, 1994) and to develop new capabilities from the knowledge created (Teece, 2000), as discussed further below. Exploration in contrast requires the development of new ideas (O'Reilly and Tushman, 2008). Balancing exploration and exploitation is essential for companies to ensure long term success. This is, as a focus on exploration could lead to high costs in comparison to new developments and a focus on exploitation to a lack of new ideas and further developments (March, 1991). Both processes build on each other and require learning processes within the organisation (Tamayo-Torres et al., 2011) being faster with exploitation building on existing knowledge and slower with exploration being based on a broader knowledge base (March, 1991).

2.3.2.4 Knowledge management stages

After having discussed different types of knowledge and knowledge exploitation and exploration as activities of KM, the next step is to look at how knowledge can be created and used in order to be beneficial for the organisation (Goh, 2002). KM is reflected in many different research streams such as the RBV, organisational learning, economics of innovation (Spender and Grant, 1996) and the KBV (Eisenhardt and Santos, 2000). Liu et al. (2014) introduces different KM stages referring to a KM life cycle and a processual perspective. They differ between 'knowledge creation, retention, sharing/transfer and application' (Liu et al., 2014, p.640). Others define KM as being "the process of

identifying, capturing, and leveraging knowledge to help the company compete” (O’Dell and Grayson, 1998, p.154). Argote, McEvily and Reagans (2003) explain KM as the creation, access and sharing of knowledge. Altogether, KM is a set of procedures (Teece, 2000).

Consequently, knowledge creation is the prerequisite for the other KM stages. Knowledge can be seen as value that resides in organisations (Bohn, 1994; Bollinger and Smith, 2001; Quintane et al., 2011) or as being created through a social process (Blackler, 1995; Cook and Brown, 1999; Quintane et al., 2011) between individuals. Which can also be defined as being a cognitive view, seeing knowledge as residing in individual heads, a structural view as seeing knowledge embedded into structural routines and rules, or a practical view with a focus on the knowledgeability (Orlikowski, 2006) of practice. Here, practise is seen as the demonstration of knowledge available (Marabelli and Newell, 2012). These approaches have quite different epistemological indications (Empson, 2001) that divide researchers in two camps either believing that knowledge resides mainly in the individual and the organisation (Nonaka and Von Krogh, 2009; Tsoukas and Vladimirou, 2001) rather than solely within the creativity of the individual (Glynn, 1996). Collective knowledge in turn is described as being a sublevel between individual and organisational knowledge. The concept of collective knowledge relates to the research stream of social capital (Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; Quintane et al., 2011). As individuals are part of organisations and knowledge can be related to all parts of the organisation, in this work knowledge is considered to reside in individuals, groups and the organisation and that the knowledge shared depends on the aim of the KS process and the individuals involved (Caimo and Lomi, 2014). Individuals can form groups of collective social capital (Lin, 2017).

Building on the above, the next step of KM is KS or KT as a prerequisite to the use of knowledge. KT cannot be described as an act, but being a constant process stimulated by the environment of the organisation and processed by the individual (Szulanski, 2000; Nonaka, 1994). KS and KT are often used simultaneously (Liu et al., 2014) both meaning the use of knowledge across firm boundaries (Caimo and Lomi, 2014). Others differentiate between KT taking place only in one direction and KS

in both directions between knowledge owner and recipient (Szulanski, 2000). Some authors also agree on seeing knowledge as a commodity based in individuals and groups and transferrable between them (Newell et al., 2009; Spender and Grant, 1996; Swan and Scarborough, 2001). In this work, the term KS rather than KT is used to emphasise the importance of all parties involved into the KS process.

KS mechanisms have been researched for example in areas such as production and high specialisation (Dyer and Nobeoka, 2000). Researchers found out that explicit knowledge can be easily shared between individuals and organisations, but tacit knowledge such as skills, know-how, and contextual knowledge can only be accessed in its application and is slow and expensive (Kogut and Zander, 1992; Nonaka, 1994). That underlines that in order to create and share knowledge within or between organisations it needs to be usable and accessible (Appleyard, 1996). Grant (1996b) developed three main knowledge characteristics that define if knowledge accessed is usable and shareable. The first characteristic, transferability, explains the accessibility of knowledge meaning if it is codified or non-codified knowledge. Knowing how is tacit and knowing about is explicit knowledge. Consequently, explicit knowledge is easy to access and use, whereas tacit knowledge is nearly impossible to access, but only usable and learnable within its context (Kogut and Zander, 1992; Marabelli and Newell, 2012). For example, by learning its routines and by application (Grant, 1996b) which makes its sharing slow, costly and uncertain (Kogut and Zander, 1992).

The second characteristic is the capacity for aggregation, as KS needs a receiving and a transmission part. The ability to absorb the knowledge, the absorptive capacity, (Berghman et al., 2013) of the receiving party plays an essential role (Cohen and Levinthal, 1990). The ability needs to be existent at individual and organisational level as new knowledge is related to old knowledge which requires a certain 'additivity between different elements of knowledge' (Grant, 1996b, p.111).

The last characteristic Grant (1996b) points out is appropriability, which refers to the return of value for the resource the holder gave away (Teece, 1998; Levin et al., 1987) as KS is based on mutuality and reciprocity. Additionally, firms need to make sure that they do not lose their competitive position by sharing knowledge (Ahuja and Carley, 1999).

In terms of KS, the conversion from tacit into explicit knowledge often leads to knowledge loss (Nonaka, 1994) and is not easy to share (Van den Berg, 2012). A common language (Goh, 2002) and a shared understanding between individuals can help to prevent knowledge being meaningless in new contexts (Polanyi, 2010; Grant, 1996b). Still, researchers think that tacit knowledge can be transferred to some extent even though it might be sticky (Szulanski, 2000) and embedded in a certain context (Inkpen and Tsang, 2005; Marabelli and Newell, 2012; Suchman, 2000) when it is made explicit (Nonaka, 1994; Marabelli and Newell, 2012). Accumulated experience facilitates the communication between individuals and hence the sharing of knowledge (Zander and Kogut, 1995). Tacit KS can therefore be enhanced by “mentoring, teamwork, chat rooms, personal intranets, and opportunities for face-to-face conversations such as group dialogue or personal reflections on experiences and lessons learned” (Goh, 2002, p.27). Even though there are several technology tools to enhance the KS processes explained above, the effectiveness in KS can only be influenced by the user of such KS technologies (Goh, 2002). This underlines the importance of the individual person within the process (Grant, 1996a; Grant, 1996b; Teece; 2000; Goh, 2002). Additional to the possible knowledge loss through knowledge conversion, knowledge retention could also lead to shedding knowledge when individuals or organisations hold back their knowledge out of strategic reasons (Levy, 2011).

Beside the challenges of KS, the ability to value information as being new is very important for successful KS (Cohen and Levinthal, 1990). This mechanism is called knowledge application (Liu et al., 2014). Especially as the development of new ideas often means the building of new created knowledge onto existing knowledge (Shafique, 2013), knowledge application is dependent on certain organisation capabilities. Existing knowledge can hinder the building of new knowledge (Lant, Milliken and Batra, 1992) as old routines within an organisation might prevent individuals from changing their attention to new routines (Kane, 2010). Kane (2010) found that a subordinate identity, a shared belief or vision, might facilitate the sharing of knowledge as well as the recognition of relevant knowledge. All parts of the KM process outlined above are influenced by the organisations

ability to share knowledge and this again influences its KS abilities in CR. Consequently, organisational factors for KS are explained in more detail in the next section of this chapter.

2.3.3 Organisational factors for knowledge sharing

Organisations can be either seen as structure giving ‘chart’ (Caimo and Lomi, 2014, p.2) influenced by formally prescribed positions (Grant and Baden-Fuller, 2004; Krackhardt and Hanson, 1993) or the ‘company behind the chart’ (Krackhardt and Hanson, 1993, p.104) as the internal patterns of behaviour or communication (Grant and Baden-Fuller, 2004; Krackhardt and Hanson, 1993). Positions are determined by hierarchy and are building a setting for social interactions (Grant, 1996b). Both views of the company, seeing it as a structure giving framework and as a network of social interactions (Argote and Kane, 2009; Dokko, Kane and Tortoriello, 2013; Kane, 2010; McEvily, Soda and Tortoriello, 2014) need to be examined in order to understand how knowledge is shared within and by the organisation (Caimo and Lomi, 2014). This relates back to the question of where knowledge resides, within the head of the individual or as March proposed within the organisation by storing “knowledge in their procedures, norms, rules, and forms. They accumulate such knowledge over time learning from their members” (March, 1991, p.73). Caimo and Lomi (2014) suggest that both approaches are needed to be taken into account, the role of the individual but also the role of the organisation as a frame giving structure in order to understand the bigger picture.

This emphasises the role of organisation structure and processes at one hand, and learning processes of knowledge integration and the development of new routines and capabilities (Grant, 1996a; Grant, 1996b), influenced by the individual (Nonaka, 1994), on the other hand. Knowledge can be shared between relations build on bureaucratic structure and authority relations (Grant, 1996b) or by social relations (McEvily, Soda and Tortoriello, 2014). Consequently, formal and informal structures can both enable as well as constrain social interaction (Caimo and Lomi, 2014) as outlined below.

2.3.3.1 Organisation structure

In order to understand how structures influence knowledge development and sharing, main structural attributes are explained in the following. Roffe (1999, p.26) for example differs between ‘mechanistic and organic’ organisations. Mechanistic organisations are based in a stable environment with strong hierarchies and control mechanisms. They are quite centralised and can adapt to changes introduced mainly by the top management (Goh, 2002; Ahuja and Carley, 1999). Nevertheless, changes also can be influenced by the individual in a bottom up process (De Wit and Meyer, 2010) as communication is organised by a hierarchical order (Roffe, 1999). Organic organisations in contrast are influenced by an unstable environment and are therefore shaped by an adaptive company structure (Roffe, 1999). Consequently, understanding organisations and their differences in structures requires an examination of their ‘degree of hierarchy, their centralisation and their hierarchical levels’ (Ahuja and Carley, 1999, p.742) as three main structural dimensions. These elements are explained in more detail below. Another view on organisation structures are formal and informal structures shaping the organisation and influencing ‘stability and instability conditions’ (Stacey, 1995, p.484). Everett and Krackhardt (2012) explained formal organisations as being influenced by the organisational degree of hierarchy as this determines the ability to directly interact or not. Companies are shaped by formal and informal structures, whereas the network of informal connections is named the ‘company behind the chart’ (Krackhardt and Hanson, 1993, p.104). While formal structures are frame giving, informal structures develop by social mechanisms. “If the formal organization is the skeleton of a company, the informal is the central nervous system driving the collective thought processes, actions and reactions of its business unit” (Krackhardt and Hanson, 1993, p.104). Even though, informal communication becomes easier with technological developments, hierarchy has an impact on informal communication (Stieglitz, Riemer and Meske, 2014). Krackhardt (1993) also found that less hierarchically influenced companies had a stronger informal communication network with a greater centrality of one responsible person for the communication.

Centrality in organisations has also a strong impact on relationship building as it is impulse giving from a central point. This means a group within the organisation is organised around a focal point which influences the centrality of decision making (Freeman, 1979). This can be formal or informal centrality. “For instance, while formal communication flows are structured, informal communications are unstructured; while the basis for power in formal organization is legitimate authority, in informal social structure it is network centrality (e.g. popularity, betweenness, and status)” (McEvily and Soda, 2014, p.305).

These considerations directly relate to the importance of hierarchical levels. Hierarchical levels determine the numbers of stages the information needs to pass (Hummon and Fararo, 1995). Hierarchical levels are coordination mechanisms in order to sample specialised units in subsystems for task execution and information passing (Simon, 1962). How hierarchy works depends very much on the organisation’s approach to it. Hierarchy as a bureaucratic system typically relies on rules and directives for authority execution but hierarchy can also be used for information and knowledge passing (Grant, 1996b). Simon (1962) even argues that hierarchies can enhance KS as it is not based on mutual information exchange due to existent authority relations. Especially in comparison to KS in poor hierarchical structures such as teams. Communication hierarchies can also be important for scattered groups to ensure exchange (Ahuja and Carley, 1999). In comparison to vertical information or knowledge flow, hierarchies have advantages and disadvantages. Employees separated by administrative boundaries are often hindered by company hierarchies in their communication (Nohria and Ghoshal, 1997; Kleinbaum and Tushman, 2007; Caimo and Lomi, 2014). Nevertheless, routine tasks with no requirement for new knowledge development can be supported by hierarchies. Complex tasks in turn, need a lot of discussion and decentralised decision making better supported by non-hierarchical structures (Ahuja and Carley, 1999).

Non-hierarchical structures are often informal structures of social relations shaping interaction on group and individual level not necessarily sticking to formal prescribed positions (Krackhardt and Hanson, 1996; Grant and Baden-Fuller, 2004). Formal organisation structures can constrain social

relations (Marsden and Campbell, 1984) and enhance them (Grant, 1996b). Often KS activities across intra-organisational boundaries are shaped by both, formal and informal relations (Caimo and Lomi, 2014). Still, extensive KS is often done within organisational units rather than across them (Argote and Ingramm, 2000) due to the proximity of their members which underlines a certain stickiness of knowledge because of bureaucratic structures (Szulanski, 2000). Nevertheless, social proximity (Stacey, 1995) and trust (Granovetter, 1973) can form intra organisational network structures that enables enhanced KS (Grant, 1996a).

There is no use in seeing informal groups not affected by organisation structure and acting autonomously (Dokko, Kane and Tortoriello, 2013). Social and business relationships overlap and influence each other but are shaped by distinct relational mechanisms (Gulati, Lavie and Madhavan, 2011). Social relations, based on informal interaction, can never be completely mapped out and drawn into a rational organisational chart (Blau and Scott, 1962). Which means that the organisation can also be understood as a complex system of social relations (Stacey, 1995; Richardson, 2008; Richardson and Tait, 2010). Complex systems can be influenced by the impact of single components (Butel, 2014). These can be social or organisational mechanisms such as knowledge stickiness towards a subordinate identity being a business unit, for example (Argote and Kane, 2009; Dokko, Kane and Tortoriello, 2013; Kane, 2010). Nevertheless, an internal KS network build on informal relations can help to manage knowledge flows and shorten communication ways (Clarysse et al., 2014; Tsai, 2001; Dyer and Nobeoka, 2000; Nonaka, 1994).

Central to social interaction within organisation structures is the building of ‘communities of interactions’ (Nonaka, 1994, p.15) with collective features and knowledge which can span departments and even organisational boundaries (Marabelli and Newell, 2012). Within this communities of interaction knowledge is shared frequently and more easily because of certain social mechanisms such as trust and common language to support the willingness to share (Goh, 2002). The key elements to enhance individual sharing of knowledge are discussed further below. Besides social relations, there are other features that can stimulate KS between group members such as knowledge

demonstrability (Kane, 2010), a common subordinate identity (Rink and Ellemers, 2008) or social identity (Haslam, 2004). This is also influenced by, and influences the organisation's collaborative culture (Goh, 2002).

All structural aspects discussed above, being hierarchical and intra-organisational network structures, as well as formal and informal structures, need to fit to company strategy and to internal and external circumstances in order to enable strategic action (McEvily and Soda, 2014).

In order to strategically adapt to a changing environment, organisations need to learn from the shared knowledge and develop new capabilities they can use to secure their competitive advantage and competitive position (Teece, 2010; Teece, Pisano and Shuen, 1997). As organisational learning plays an essential role to enable KM and use KS (Lavie, Stettner and Tushman, 2010) it is outlined in the next section of this chapter.

2.3.3.2 Organisational learning

Organisational learning can take place when existing knowledge is deepened or new knowledge is generated to build up skills (Teece, Pisano and Shuen, 1997). Consequently, the learning organisation is also seen as a knowledge integration institution, which Grant (1996b) describes as follows. Sustainable competitive advantage roots in the ability to integrate knowledge and develop new capabilities by using the knowledge. The concept of capabilities is explained in the next section. Rules and routines enable organisational knowledge integration having an influence on hierarchical levels and the location of decision making (Grant, 1996b) and being influenced by these aspects. Grant identifies four integration mechanisms to integrate mainly specialised knowledge being 'routine, directives, rules and group solving' (Grant, 1996b, p.144). Rules and directives are standards set by the organisation. Group solving requires intensive communication among group members enabling learning through discussion. Routines are particularly important as they are the prerequisite for organisational learning (Eisenhardt and Martin, 2000). Winter (2003, p.991) defines routine as "behavior that is learned, highly patterned, repetitious, or quasi-repetitious, founded in part in tacit

knowledge”. Routines can have an advantage in sharing and integrating tacit knowledge (Grant, 1996a) as they can transport complex patterns of behaviour (Pentland and Rueter, 1994). New knowledge needs to be linked to old knowledge in order to create new rules, routines and directives (Grant and Baden-Fuller, 2004; Conner and Prahalad, 1996). While routines seem to have an advantage in integrating tacit knowledge, direction is increasingly helpful when the activity or task is complex (Grant 1996a). Routines are necessary for repetitive tasks but not for non-repetitive tasks such as required for innovation (Baron, 1992). This underlines that information and knowledge processing depend highly on the right fit between tasks and the environment in which the task is fulfilled. Routines vary from robust and channelled routines in less dynamic markets and weak and less substantial ones in high-velocity markets (Eisenhardt and Martin, 2000). This means in turn that learning mechanisms and knowledge integration differs in different type of markets and different market demands. “In moderately dynamic markets, dynamic capabilities resemble the traditional conception of routines. They are detailed, analytic, stable processes with predictable outcomes. In contrast, in high-velocity markets, they are simple, highly experimental and fragile processes with unpredictable outcomes” (Eisenhardt and Martin, 2000, p.1105).

Routine development is therefore dependent on the environment the company is in and what knowledge is aimed at as well as on the type of knowledge activity such as exploitation or exploration (March, 1991). Grant (1996b) stated when knowledge is shared through a common language, directions and routines can be developed and shared more easily. From his point of view bureaucracies can enable knowledge integration and therefore organisational learning and the development of capabilities (Grant, 1996b).

2.3.3.3 Organisational capabilities

Capabilities are what companies or individuals are able to do, being a ‘set of processes’ (Eisenhardt and Martin, 2000, p.1105) consisting not only of intangible assets such as knowledge but also of certain tangible assets (Ambrosini and Bowman, 2009). Capabilities are developed by creating,

incorporating, rearranging and giving away resources (Eisenhardt and Martin, 2000), and are in turn important to fulfil these actions. Developing capabilities is a process determined by resource exchange. Competitive advantage is reached by developing value creating strategies using available resources (Penrose, 1959; Barney, 1991; Peteraf, 1993; Wernerfelt, 1984; Teece, Pisano and Shuen, 1997; Shang, 2014). The development of new capabilities is essential to enable organisational learning and learning enables capability development (Helfat and Peteraf, 2003; Curado, 2006). There are certain organisational and individual processes at the basis of the development of capabilities.

Individuals create actions and sequences of actions that result in routines and as a consequence in strategic capabilities (Pentland et al., 2012; Sele and Grand, 2016). This means that the actions and characteristics of the individual are essential to capability building as they are key to share knowledge and shape strategy. Especially when strategy is emergent (Tidström and Rajala, 2016). Consequently, actions are on the basis of individual behaviour. Actions in bundles can be used to explain social phenomena (Schatzki, 2011). When these patterns of action repeat themselves and start to be present in the everyday functioning of the firm, they are building routines (Cyert and March 1963; Nelson and Winter, 1982; Sele and Grand, 2016). Developing routines is important in established environments as they enable to optimize organisational processes and outcomes. They are furthermore the micro-foundation of capabilities (Sele and Grand, 2016). Meaning, that bundles of activities and repeating activities that build up routines can build capabilities (Gulati, Lavie and Madhavan, 2011; Cohen and Levinthal, 1990), as well as support emergent strategy and execute strategic action (Child, 1997) as introduced by the strategy as practise approach (Jarzabkowski, 2002; Jarzabkowski, Balogun and Seidl, 2007; Jarzabkowski and Spee, 2009).

Consequently, capabilities can be developed by characteristics and actions or interactions (Grant, 1996a) of the individual and the company (Grant and Baden-Fuller, 2004; Håkansson and Ford, 2002). Company characteristics can be “structure, culture, technology, identity, memory, goals, incentives, and strategy. The context also includes relationships with other organizations through

alliances, joint ventures, and memberships in associations” (Argote and Miron-Spektor, 2011, p.1125).

Capabilities are therefore influenced by internal aspects such as behaviour and structure, actions and characteristics, and by the external environment enabling certain firms to be more capable than others (Demsetz, 1973; Kodama, 2007).

Capabilities are important for strategic orientation and to react to changing environments (Teece, Pisano and Shuen, 1997). Especially dynamic capabilities are developed to modify competencies in order to be able to adapt to the changing environment (Teece, 2000; Eisenhardt and Martin, 2000; Ambrosini and Bowman, 2009). Depending on their strategic importance capabilities can be part of core competencies (Eisenhardt and Martin, 2000), which are competencies that are essential to gain competitive advantage (Hamel and Prahalad, 1990). They are important to execute strategy (Hrebiniak and Snow 1982; Shang, 2014) and to reach a strategic fit (Grant, 2013). Capability management is seen as an extension of the RBV and sees resource management not only as the ability to control tangible resources but also the management of individuals (Leonard-Barton, 1995).

Capabilities are built of knowledge (Leonhard-Barton, 1998) and knowledge again is required to build up new capabilities. Goh and Richards (1997) identified five key attributes of the learning organisation, one being the ability to share or transfer knowledge for which capabilities are key (Teece, 2000). One of these capabilities is again the company’s absorptive capacity as the ability to access and assimilate knowledge (Zheng, Zhang and Du, 2011). Learning capacity and absorptive capacity are highly related and critical for knowledge assimilation (Cohen and Levinthal, 1990; Tsai, 2001) and its exploitation (Berghman et al., 2013). Consequently, absorptive capacity of a firm does not only include the comprehensive access of knowledge but also its creation, coding and encoding, its effective transfer (Cohen and Levinthal, 1990) and its internalisation (Kale, Dyer and Singh, 2002). Berghman et al. (2013, p.43) found that knowledge recognition, assimilation and exploitation are active “learning mechanisms that foster the capacity to recognize new opportunities and options...and shall stimulate an ‘open-minded’ recognition, assimilation and exploitation of external knowledge”.

These three dimensions are combined in a company's absorptive capability (Zheng, Zhang and Du, 2011) but they need to be addressed actively and consciously in order that these knowledge dimensions do not become 'information-rich, but interpretation-poor systems' (Berghman et al., 2013, p.43).

Summarising the above, knowledge as a resource is important for capability development and capabilities are important to access knowledge. Capabilities are the result of routine development and learning by the use of knowledge in combination with company assets. In order to better access knowledge and other resources, network relationships can be maintained (Zheng, Zhang and Du, 2011). They can enable companies to access idiosyncratic resources, build up competitive advantage and innovate. KS capabilities differ in their importance to the company and different mechanisms enable to access different kind of knowledge (Zheng, Zhang and Du, 2011) which is also greatly influenced by the organisational culture (Goh, 2002; Al-Alawi et al., 2007).

2.3.3.4 Organisational culture

Having investigated the frame giving requirements on organisational and individual level, the company behind the chart will be explained further. As mentioned above, the organisational culture plays an essential role for KS (Goh, 2002). Grant (19964a) sees organisational culture as a form of common knowledge. This is supported by Park et al. (2004), seeing organisational culture as basic assumptions shared. Different practises belong to the organisational culture as well as shared values and symbols (Ajmal and Koskinen, 2008). In terms of these identity giving patterns, every organisation is unique in culture determined by values, philosophy and a mission of the company which guides employees. Additionally, organisational culture is often seen as key enabler of KS (McDermott and O'Dell, 2001). Culture also influences how employees react towards change and how they approach new ideas (Ang and Massingham, 2007; Lucas, 2010). Organisational culture reflects not only the value within a group of employees but also their actions, how they behave and what they expect (McDermott and O'Dell, 2001; Simonin, 2004). This underlines that organisational

culture is both, a group and an individual phenomenon (Lucas, 2010). Therefore, culture can enhance KS when individuals are encouraged to participate actively in the process of sharing information (Ang and Massingham, 2007; Bender and Fish, 2000).

Goh (2002) underlines this assumption by stating that a collaborative culture can influence KS positively whereas less collaborative cultures can hinder KS. He identifies organisational culture as being essential for KS. Additionally, he introduces some other key supporting elements such as technology, low hierarchical levels, horizontal knowledge flows through group work, reward systems, leadership enhancing collaboration, the type of knowledge and its transferability, the KS capacity of the recipient and the characteristics of the recipient being an individual person (Goh, 2002). This view is supported by Gupta and Govindarajan (2000, p.72) seeing organisational culture shaped by 'information systems, people, process, leadership, reward systems'. Taken all elements and categories together they refer to the organisation as a whole including the structure of the organisation, as well as the social relations within the company, including the importance of individual and group behaviour. The behaviour of the individual shapes not only organisational culture (Wallace, Hunt and Richards, 1999; Erez and Gati, 2003) it also plays a vital role for KS (Nonaka, 1994), organisational learning, capability building and strategy making (Eisenhardt and Santos, 2000; Jarzabkowski and Spee, 2009). Different information systems can facilitate KS (Govindaraja and Gupta, 2001) but the use of technology and its effectiveness still depends on its user which brings back the role of the individual as a key factor for the success of KS (Ahuja and Carley, 1999; Goh, 2012; Teece, 2000).

2.3.3.5 Organisations and the individual

The debate about where knowledge resides, in the head of individuals or in routines, direction or culture of the organisation is still ongoing and has already been outlined above. Grant (1996b, p.375) argues that "If the strategically most important resource of the firm is knowledge, and if knowledge resides in specialized form among individual organizational members, then the essence of organizational capability is the integration of individuals' specialized knowledge". As organisations

are populated and run by individuals who in turn influence KS to a great extent, individual and organisational aspects are both essential (Newell et al., 2009; Spender, 1994; Swan and Scarbrough 2001). “While most explicit knowledge and all tacit knowledge is stored within individuals, much of this knowledge is created within the firm and is firm specific” (Grant, 1996b, p.111).

Some researchers argue that the collective level, the group level of a company, has been over emphasised from a KS perspective. Research concentrates on how groups interact in their organisational work unit (Brass et al., 2004) influenced by formal relationships (Ghoshal and Bartlett, 1990; Nohria and Ghoshal, 1997) or in their network of social relationships (Kilduff and Tsai, 2003) and social communities (Swan, 2001). The critique is that the group is emphasised although such groups consist of individuals as well (Marabelli and Newell, 2012). Research focuses on the embeddedness of individuals in groups and their behaviour to each other (Kilduff and Brass, 2010) instead of looking at individual’s characteristics. The advice relation between manager and individual employee can also play a role, managers can enhance KS between individuals by their leadership style supporting and underlining a collaborative culture (Caimo and Lomi, 2014).

In order to enhance learning and KS between individuals, leaders need to install triggering mechanisms for KS (Berghman et al., 2013). This can be different features on an organisational level that are supposed to support individual KS as the use of communication technology, reward systems or leadership enhancing collaboration as already outlined above (Goh, 2002).

Communication as an important factor can be triggered by directions but is greatly enhanced by social networking in the organisation (Smith and Rupp, 2002; Brass, 1984). Furthermore, shared experiences can help to a quicker learning between individuals and can connect existing knowledge to new knowledge (Zander and Kogut, 1995). Related to a shared experience, the role of common language and common knowledge, which can develop out of shared experience as well, needs to be considered. Common knowledge means shared knowledge, symbols, habits or a common knowledge base of a certain topic. Information shared without a certain knowledge base or common language

will not be shared that easily (Caimo and Lomi, 2014; Reagans and McEvily, 2003; Tortoriello, Reagans and McEvily, 2012).

Beside mechanisms that enable and trigger KS between individuals other factors such as trust, reciprocity, perception of risk and power influence the willingness to share knowledge (Caimo and Lomi, 2014; Goh, 2002; Gupta and Govindarajan, 2000; Reagans and McEvily, 2003; Tortoriello, Reagans and McEvily, 2012). Especially in terms of information systems, which are seen as supporting tools for communication and KS, motivation is a key factor for the usage of technological enablers (Goh, 2002). Researchers found that the motivation process is raised by the perception of knowledge relevance (Petty and Wegner, 1998).

Trust between interacting individuals is seen as the essential influencing factor for KS as it is about reliability of action and the fulfilling of expectations (Politis, 2003), which is a basis to opening up the individual knowledge willingness for KS (Gruenfeld et al., 1996).

Status and power of the individual are very influential as well. Power itself is always seen within a relation, questioning above whom the individual has power (Emerson, 1962). Power is always relative, as some actors might control relevant resources (Brass et al., 2004) and others might contain about other important resources such as linkages to other actors (Blau and Alba, 1982). Some managers might use status (Arya and Lin, 2007) and information or knowledge itself as a source of power and will not share it in order to increase their power (Goh, 2002). Therefore, power among each other can be seen as an important KS influencing factor.

Nevertheless, the willingness to share knowledge cannot be forced and KS and KT are subject to the will and the ability of the individual when advice relations lose their influence (Arya and Lin, 2007; Caimo and Lomi, 2014; Zander and Kogut, 1995). Trust is the main driver for collaboration among individuals and openness to KS strongly influencing the personal willingness to share knowledge. This can also be related to knowledge retention as KS is often considered as a loss of knowledge ownership (Alsharo, Gregg and Ramirez, 2017). Additional to that, the personal motivation (Hwang,

Lin and Shin, 2018) as well as personal aim orientation following an alignment of personal interest (Bosse and Phillips, 2016) play an important role for KS willingness.

Contributing to influencing factors from the outside, the individual's characteristics may also enhance or hinder KS. The human brain has a natural limit to access and store knowledge which is called bounded rationality (Grant, 1996b) which in turn influences the ability to produce new knowledge. The same applies for the ability to combine knowledge (Teece, 2000) and understand knowledge which is all limited to a certain ability of the human brain as well as personal characteristics of the individual (Kane, 2010). Characteristics of the individual and their influence on KS and motivation to share knowledge have not been a focus in research so far (Hwang, Lin and Shin, 2018).

2.4 Network level

After having emphasised the role of the organisation and the individual for KS and how organisations differ, this section outlines how CR are structured and shaped. The aim is to understand how organisations can be embedded in CR and how this influences their ability to share knowledge, fulfil their strategy and gain competitive advantage.

2.4.1 Collaborative relationships and networks

Summarising the findings outlined above, knowledge can reside in both either in organisations or in the individual within or outside the organisation. Especially as companies are shaped by idiosyncratic resources, the ability to share resources and knowledge is one of the main motives to form collaborative groups outside of the organisation.

Forming groups for KS outside the organisation means building up a network of relationships or ties. McEvily and Zaheer (1999, p.1136) see CR as being 'typically characterized as a web of dense and overlapping ties'. These can be distinct ties such as professional partners or personal contacts inside and outside of business (Sorenson, Folker and Brigham, 2008; Gulati, Nohria and Zaheer, 2000). Therefore, CR can be grouped in many different ways (De Jong and Hulsink, 2012) such as into social, economic, and professional networks (McEvily and Zaheer, 1999) or indirectly and directly

related agents (De Wit and Meyer, 2010). As type of ties and the availability of relations differ depending on business interests and positions within the CR, the willingness to collaborate and the need for competitive advantage can be distinct among collaborating firms (Gulati, Nohria and Zaheer, 2000). Ahuja (2000) as well focuses on the role of linkages when defining CR. In this research CR are seen as being based on direct or indirect interaction (Gulati and Singh, 1998), on formal or informal relationships, grouped into networks when they follow a mutual strategic aim or interest (Gulati, Nohria and Zaheer, 2000).

In order to understand organisations and KS in CR, the network level needs to be investigated as CR can be grouped into networks for example (Ahuja, 2000). The terms network and CR will consequently be used interchangeably. CR shape the company environment and are therefore essential to understand the external factors companies and individuals are facing (Argote and Miron-Spektor, 2011).

2.4.2 Resource sharing in collaborative relationships

Research on CR concentrates for example on benefits deriving from resource exchange (Ahuja, 2000; Gulati, Lavie and Madhavan, 2011). Resources can be exchanged in many different ways such as resource adaption, resource acquisition through market exchange or by informal or formal networking (Jones, 1997; Newman and Park, 2003). CR provide a strong benefit on mutual resource sharing for the organisations involved (Ahuja 2000; Powell et al., 1996). Even though CR are essential for gaining external knowledge the organisation itself has rarely been unit of analysis. Despite the quite substantial body of research on performance indicators for networks, there has been less attention on how exactly organisations use certain mechanisms on resource sharing or KS. Additionally, the success factors of organisations maintaining CR and managing KS remain blurred (Gulati, Lavie and Madhavan, 2011). The focus of research has mainly been on the network as a whole concentrating on the embeddedness perspective, seeing companies as being part of a network strategy and highly intertwined with the network (De Wit and Meyer, 2010). Research remains on a network level, not

showing what implications mean for the organisation itself and how it can reach the positions (Brass et al., 2004). Additionally, researchers have distinguished between relations and structures that can be found due to resource exchange without investigating the actual resource sharing process between network agents (Gulati, Lavie and Madhavan, 2011).

Some research has focused on structural differences in networks and how networks can support the company performance (Ahuja, 2000; Gulati, 1995; Gulati, 2008; Gulati, Lavie and Madhavan, 2011; Rowley, Behrens and Krackhardt, 2000). Whereas others investigated certain network characteristics that can enhance the network performance such as structural holes (Burt, 1992), centrality in networks (Freeman, 1979) and density of networks (Coleman, 1988).

These researchers concentrated on investigating social networks. The results of their work have often been used for business networks simultaneously. It remains critical and questionable if social mechanisms can be applicated to business contexts. Social network theory is often seen as a methodological approach rather than a theory, being mainly descriptive. Still, social mechanisms are at the basis of the social network theory (Borgatti et al., 2009; Scott, 2017) and the context they are in needs to be considered. The second focus of research on networks relates to ties and how they shape and influence networks with their quality (Gulati, Lavie and Madhavan, 2011; Borgatti and Halgin, 2011). Especially, how ties can affect the access to certain network resources is key here (Dyer and Nobeoka, 2000; Dyer and Singh, 1998; Gulati, Lavie and Madhavan, 2011; Uzzi, 1997).

Referring to the above, research on networks has concentrated on the social side of networks (McEvily and Soda, 2014). Although not directly being linked to business context (Arya and Lin, 2007), social network theory has been taken to explain business processes as well. Furthermore, social network analysis (SNA) is a method to access social networks in a quantitative way by measuring proximities, nodes and relations (Scott, 2017). SNA emphasises the role of the network as a whole (Otte and Rousseau, 2002) rather than considering network attributes that have an impact on the resource sharing ability of the single organisation. In this work, ideas of social network research are

considered for describing the network as a whole. Still, the organisation remains the unit of analysis, as further explained in the methodology chapter.

Beside the network level of research, some scholars realised that the role of the organisation itself is vital to explain how resources are shared and how they can be incorporated after having them accessed through the network (Cohen and Levinthal, 1990; Tsai, 2001). As outlined above, the key resource for gaining competitive advantage is knowledge (Grant, 1996b), therefore the next section discusses KM in CR.

2.4.3 Knowledge management and sharing in collaborative relationships

As already outlined above, CR are characterised by linkages of interaction (Auster, 1992) as well as repeating and enduring exchange of information (Inkpen and Tsang, 2005) shaped by channels of communication (Gulati, 1995) and KS (Gulati and Gargiulo, 1999). They can exist inside and outside the organisation (Roger and Kincaid, 1981).

Similar to the debate of where knowledge resides within the organisation, a debate developed about knowledge in networks residing within the linkages or within the network as a whole. This debate is found among others in research about social capital (Nahapiet and Ghoshal, 1998) outlined further below. Podolny (2001, p.35) states that networks are not only “pipes carrying the stuff of the market; they are prisms, splitting out and inducing differentiation among actors on at least one side of a market”. Meaning that the relationship as well as the node, being the organisation or the individual, can carry knowledge (Brass et al., 2004). This view is also followed in this work.

Despite to the question of where the resources are stored and how the network partners are intertwined, another important aspect is how knowledge can be accessed, managed and incorporated. CR can be superior to firm’s ability to create knowledge, when first mover advantage or uncertain environments exist and when there is a need for specialised knowledge and existing routines and directions need to be overcome (Grant and Baden-Fuller, 2004). Furthermore, when companies chose to explore new knowledge, CR can enable knowledge access to a variety of partner resources. New

knowledge that can then be explored due to distinct knowledge bases available. This underlines the possibility for companies to create new combinations of knowledge and explore new knowledge (Arya and Lin, 2007; Shafique, 2013). For the single company networks can offer additional advantages in new knowledge access, as they do not need to build up routines (Grant and Baden-Fuller, 2004) but can build up a KS network (Marabelli and Newell, 2012; Caimo and Lomi, 2014). In contrast to the possibility to better access knowledge, CR or network relations are inferior in knowledge integration. They cannot develop directions and routines and they might not be able to develop the same amount of capabilities out of the knowledge accessed as the single organisation would be (Grant, 1996a; Grant, 1996b; Zander, 1995; Teece, 2000). Especially, as they need to deal with a high amount of knowledge that is accessed. This also means that network structures are generally inferior using ‘higher-order organizing principles’ (Grant and Baden-Fuller, 2004, p.68) as they have no authority based relationships (Ahuja and Carley, 1999). Knowledge integration and learning is therefore important to be done on the organisational level to sustain the competitive advantage of the single company (Teece, 2000).

Organisations can benefit from using CR for accessing knowledge and being also able to integrate it, therefore the aim orientation of the organisation in CR is essential. When organisations just want to adapt resources to their own resources they acquire resources through exploration. Resources assessing happens through exploitation (March, 1991; Grant and Baden-Fuller, 2004). For both activities the company needs to be able to learn and should have a certain absorptive capacity (Cohen and Levienthal, 1990) as knowing about existing knowledge is important as basis for knowledge exploration and exploitation. Conner and Prahalad (1996, p.477–501) use the term ‘knowledge substitution’ which could also be described as matching old to new knowledge (Berghman et al., 2013).

As networks offer resource exchange benefits as well as KS advantages, organisations in networks might profit from being in collaborations when they are able to use the knowledge that has been shared and match it to their own strategy, vision and aim (Lorenzoni and Baden-Fuller, 1995). The

access to knowledge in collaborations depends very much on the aim that is targeted by its members and by the resource exchange, such as the aim of new market entrance (Danneels, 2008) or developing new business models (Chesbrough, 2010).

Companies in networks can either access and integrate knowledge or just process it to other network partners (Ahuja, 2000) and serve as a KS hub (Lee et al., 2017). The sharing of knowledge between partners is influenced by the knowledge that is wanted to be shared, as explicit knowledge can be shared context independent while tacit knowledge needs to be shared through practise and content relation (Marabelli and Newell, 2012) which requires a high level on interaction, closeness and communication. Therefore, KS activities of single organisations depend very much on the company aim as well as the network aim (Grant and Baden-Fuller, 2004; De Wit and Meyer, 2010). Being able to influence knowledge accessed and shared means to be able to maintain the network of relationships by regular interaction, management of the relations, joint goals and mutual dependency (Galaskiewicz, 1985) being the basis for network governance (Gulati and Singh, 1998). Network governance mechanisms will be outlined below in more detail.

2.4.3.1 Knowledge sharing enablers and hindrances

Beside their own ability to explore knowledge and share knowledge in networks, companies need to consider some other KS enablers and hindrances. First of all, the knowledge type can be a hindrance or a facilitator to share knowledge depending on company aim and network characteristics. As already outlined above, researchers found that explicit knowledge can be easily transferred between individuals and organisations, but tacit knowledge such as skills, know-how, and contextual knowledge can only be accessed in its application and is slow and expensive (Grant, 1996a; Kogut and Zander, 1992; Nonaka, 1994). In CR tacit knowledge is either transferred by proximity, informal ways such as social relations (Hoffmann et al., 2011) or through an informal KS network with strong rules for participation (Dyer and Nobeoka; 2000; Nonaka, 1994). Strong rules for participation can be rules of interaction that especially develop during long term CR (Clarysse et al., 2014). Informal

KS networks can be based on social relations that help to manage knowledge flows within partnerships (Dyer and Nobeoka, 2000; Nonaka, 1994). That is, to say a two-layer network perspective, as CR can exist at the same time due to formal relationships based on resource exchange, that belong to their value chain (Hinterhuber, 1994).

Summarising the above, CR with informal KS network or well-developed KS routines (Dyer and Nobeoka, 2000) will be able to better share knowledge. KS routines cannot often be found in networks, and if, they are more likely to develop in closed networks (Coleman, 1988; Walker, Shan and Kogut, 1997) than in more open networks (Grant and Baden-Fuller, 2004) due to their deep interaction of network agents. The role of closed and open networks will be further explained below in the section about network structures.

Particularly geographically dispersed networks need good KS mechanisms to ensure effective KS between their partners (Hoffmann et al., 2011). In contrast, clusters are influenced by a great geographical proximity of actors enabling close and direct interaction (Powder and St. John, 1996). Therefore, proximity as KS mechanism has been researched in the areas of geographical clusters. Proximity means the closeness of actors to each other (Inkpen and Tsang, 2005) and it can enable KS as actors can maintain a strong frequency of interaction (McEvily and Zaheer, 1999) and the sharing of tacit knowledge (Helmsing, 2001).

Beside proximity, social relations that form informal networks of exchange play an important role for successful KS in CR (McEvily and Zaheer, 1999) as explained at the beginning of this section. Due to the importance of social relations for KS, they are outlined in more detail below. Social ties can reduce organisation and monitoring costs for the effective use of network resources between networking organisations (Dyer and Singh, 1998) and can facilitate the exchange of tacit based knowledge and experience (Hoffmann et al., 2011). Nevertheless, social relations can also raise a certain complexity as they are defined by mutual dependence between interacting parties (Emerson, 1962), as well as possible interpersonal hierarchical subordination (Caimo and Lomi, 2014). Mutual dependence in turn influences reciprocity which is the mutual exchange of resources and not a one-

sided approach to KS (Ahuja and Carley, 1999). Reciprocity is seen as a structural characteristic of social relations that can affect hierarchical structure and hierarchical dependence of individuals (Caimo and Lomi, 2014). The hierarchy in networks is shown by the degree of how reciprocal relationships are in networks (Krackhardt and Hanson, 1993). Less reciprocal relationships can be teamwork; strong reciprocal networks would be more hierarchical than teams (Ahuja and Carley, 1999). Reciprocity can promote trust (Uzzi, 1997) as well as close interaction and the understanding of complex problems (Tortoriello and Krackhardt, 2010). Consequently, reciprocity is an important determinant for KS (Caimo and Lomi, 2014) as it raises the question of equality in relationships (Emerson, 1962).

Summarising the above, even though there is no strong hierarchy present in social relations that form informal networks, reciprocity and mutuality can determine a certain hierarchy and therefore influence the flow of knowledge between individuals within the network. By informal and formal patterns of behaviour they form network relations of different kind (Jones, Hesterly and Borgatti, 1997; Caimo and Lomi, 2014) influencing the structural attributes of network and KS, as outlined in the next section.

2.4.4 The role of network structure and knowledge sharing

Network structure is influenced by structural embeddedness and relational embeddedness. Both aspects are highly intertwined and interrelated even though they contain some contradictions (Granovetter, 1985; Burt, 1992). Researchers argue that structural embeddedness is the underlying basic for relational embeddedness which is then influenced by formal and informal structures or relationships (Jones, Hesterly and Borgatti, 1997). Rowley, Behrens and Krackhardt (2000) state that both perspectives influence firm results and interaction and can only be understood when they are referenced to each other. Whereas structural embeddedness points out how ties in a network are structured, relational embeddedness refers to the type of ties and their characteristics (Rowley, Behrens and Krackhardt, 2000). Nevertheless, both approaches also complement themselves as type

of relationship and tie structure cannot be viewed separately. Additionally, the degree of embeddedness directly relates to the ability of companies to acquire and create knowledge as well as to develop capabilities (Zheng, Zhang and Du, 2011).

In order to have a strong resource exchange network “constructs of structural, relational properties and the capabilities needed to the three constructs of reach, richness and receptivity” (Gulati, Lavie and Madhavan, 2011, p.211) need to be considered. Reach is linked to the network structure the organisation is in and explains the possibility to make contacts reachable. Richness links to the variety of ties and receptivity refers to the absorptive capacity of the organisation being in the network (Gulati, Lavie and Madhavan, 2011). These constructs consider to the uniqueness of organisations, as every organisation has a different ‘reach, richness and receptivity’ and different capabilities to gain advantage out of KS within the network. In contrast to that, both embeddedness perspectives refer to network attributes that do not consider the attributes of the single organisation. In order to understand network structure terminology and networks as a whole, structural and relational embeddedness are discussed in the next two sections.

2.4.4.1 Structural embeddedness

Especially the debate between Coleman’s theory of closed networks and Burt’s understanding of sparse networks, including the benefits of structural holes, indicates how different the view of structural embeddedness and its potential benefits can be (Burt, 1992; Coleman, 1988). Coleman (1988) understands a dense and closed network as being superior in creating trust and cooperation, whereas Burt (1992) suggests that sparse networks enjoy greater benefits in accessing new resources from outside the network core. From Burt’s (1992) point of view, structural holes in sparse networks enable to exploit gaps and non-redundant resources in networks. By bridging structural holes new access of information between actors is possible (Burt, 1992; Hargadon and Sutton, 1997) as relationships are built with ‘multiple disconnected clusters’ (Ahuja, 2000, p.425). Better positions result from better connections spanning more structural holes (Burt, 2004) which offers new ideas

(Burt, 2004; Burt, 2015), an information rich network (Burt, 1992) and competitive advantage to the firm (Arya and Lin, 2007). Grant as well argues for a wide set of linkages to profit from organisations in networks (Grant 1996a). The diversity reached by collaboration supports companies to get more and diverse knowledge for an innovative use of knowledge (Brass et al., 2004; Zheng, Zhang and Du, 2011). This approach to networks as open networks (Ahuja, 2000) is named sparse (Rowley, Behrens and Krackhardt, 2000) or disconnected network structure (Ahuja, 2000).

Coleman (1988) instead argues for the advantages of strongly embedded and closed network structures being superior to more open networks. Densely embedded networks with many connections between the agents and well developed social structures are seen as ‘closed networks’ or ‘closed communities’ with stronger rules of interaction (Coleman, 1988, p.99). Having a better control of network outcome and a more structured communication, the social capital in such closed network is more beneficial and can be better used than in open networks (Ahuja, 2000; Coleman, 1988; Walker, Shan and Kogut, 1997). Both structural embeddedness perspectives refer mainly to the interaction and the proximity of the partners. This is also determined by the type of relationship between actors which is explained in the next section.

2.4.4.2 Relational embeddedness

Researchers found that network embeddedness does not only refer to structural aspects but also to relational aspects (Ahuja, 2000). Granovetter (1973, p.1361) introduced the idea of tie strength as the “combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterise the tie.” Another important aspect is the degree of commitment of the partners, the overlapping of objectives and maintenance effort put into the relationship (Gulati, Lavie and Madhavan, 2011) to see if a company benefits from its social relations. Granovetter (1973) argues further, that intensity and intimacy within a network can have strong effects on resources exchanged. Tie strength also moderates influence in the network (Aral and Walker, 2014).

Relational embeddedness differs between strong and weak ties. Strong ties are characterised by strong relationships build on trust, detailed information exchange (Uzzi, 1997; Larson, 1992; Krackhardt and Hanson, 1993) and frequent interaction (Palmatier, Gopalakrishna and Houston, 2006). As this partnerships are based on a mutual and deeper understanding, the sharing of information and knowledge, in particular tacit knowledge, is facilitated (Uzzi, 1996). Strong ties are also part of 'social control mechanisms' (Rowley, Behrens and Krackhardt, 2000, p.371) in networks which can be stronger than formal governance mechanisms.

Weak ties, described as 'local bridges' (Granovetter, 1973) are not that strongly connected but more likely to deliver new information and knowledge. Weak ties therefore relate to Burt's (1992) idea of structural holes which highlights the overlap of structural and relational embeddedness (Rowley, Behrens and Krackhardt, 2000). Sparse structures between weak ties allow the access to new and undetected knowledge (Burt, 1992). From Granovetter's (1973) perspective, weak ties are responsible for new information development being influenced by infrequency of interaction. This infrequency is key in order to detect new opportunities.

McEvily and Zaheer's (1999) concept of bridging ties stresses the idea that ties bridging to other networks enable heterogeneity being a key for competitive advantage. Bridging ties can be strong or weak ties and are essential to the creation of new knowledge, ideas and opportunities (McEvily and Zaheer, 1999). Essential characteristics of bridging ties are non-redundancy, which means non-overlapping ties, and tie strength based on infrequency of interaction. The latter means the extent of communication and the geographic dispersion. Bridging ties span structural holes and they can be weak and strong. Additionally, they belong not only to economic contacts but also to professional and social circles (McEvily and Zaheer, 1999). The importance of frequency of contact and dense communication (Gupta and Govindarajan, 2000) with these actors, as well as the specifics of the actors (McEvily and Zaheer, 1999), refers to relational embeddedness. Consequently, their concept considers structural and relational embeddedness simultaneously.

Researchers in network theory stress the importance that both views on embeddedness can complement each other and that they refer to different aspects, different purposes and different qualities in tie characteristics (Rowley, Behrens and Krackhardt, 2000). Firms will have a mixture of different ties depending on their aims and possibilities which again influences their structural embeddedness. “Thus, weak ties that facilitate information collection are more valuable when there is much information to collect, while strong ties are more important when firms seek to reduce competitive intensity in stable industries” (Brass et al., 2004 p.806).

Ahuja (2000, p.429) also differs between ‘degree of connectivity’ of direct and indirect ties. Direct ties are seen as enabler for KS but as a hindrance for absorbing new knowledge, as they provide less flexibility in interaction. Contrariwise, too many indirect ties, spanning structural holes, can have a negative effect on innovation performance. Direct ties in turn offer an enhanced innovation performance by offering better KS (Ahuja, 2000; Berg, Duncan and Friedman, 1982).

Additional to that, KS enabler are ties that are built on social connections whereas strong ties can enhance the sharing of complex knowledge and weak ties are more suitable for sharing less complex knowledge (Brass et al., 2004; Hansen, 1999; Tsai, 2001). The variety and quality of network ties is therefore essential for information and knowledge creation.

Summarising the above, even though both approaches are seen as ‘independent constructs in the literature’ (Rowley, Behrens and Krackhardt, 2000, p.370) they are jointly contributing to the way CR are built up. Additional to that, structural and relational embeddedness are the basis for resources available in CR, being the social capital perspective discussed in the next section.

2.4.4.3 The role of social capital

As already pointed out above, it is essential for the organisation to decide what network relations and structures to maintain in order to reach a fit between network structure and organisational requirements (Rowley, Behrens and Krackhardt, 2000). These considerations refer to the importance of social capital in the network and how to best access it. Nahapiet and Ghoshal (1998, p.243) see

social capital as “the sum of actual and potential resources embedded within, available through and derived from the network of relationships possessed by an individual or social unit”.

Social capitalist researchers argue that better connections within networks can have advantages in comparison to less good connections (Gulati, Lavie and Madhavan, 2011; Rowley, Behrens and Krackhardt, 2000). Dense ties and a closed network offer a collective social capital (Coleman, 1988) strongly influenced by social norms (Rowley, 1997) whereas ties to multiple actors covering structural holes might offer richer social capital enabling information advantage (Gulati, Lavie and Madhavan, 2011).

Which way of embeddedness should be taken and how social capital can be built up depends as well on how resources are accessed. Organisations that exploit resources have different information requirements than organisations that explore resources (Berghman et al., 2013; Grant and Baden-Fuller, 2004; Ghoshal and Moran, 1996; Hoffmann et al., 2012). Rowley, Behrens and Krackhardt (2000) explain the relations as follows. When organisations explore new information, many different alternatives are considered, and the information accessed is broad and general. The emphasis is on exploring alternatives rather than reaching specialisation or full understanding. Exploitation in turn emphasises on gathering specific knowledge which can be tacit as well. Ties that can be addressed here are rather defined and limited (Rowley, Behrens and Krackhardt, 2000). Knowledge exploration can play a vital role in surroundings where no further specialisation is required but additional and new knowledge is needed (Dyer and Nobeoka, 2000).

Social capital therefore can, when well developed and addressed, support organisational performance (Nahapiet and Ghoshal, 1998), innovation (Ahuja, 2000; Tsai and Ghoshal, 1998) and KS (Inkpen and Tsang, 2005). Most studies have researched the importance of social capital and superior resources in comparison between organisations and their competitors (Gulati, 1995). The question remains unanswered how company’s individual characteristics and actions undertaken and their capabilities and network resources can help them to get superior resources in order to convert them into competitive advantage. The considerations above, relating to different structural and relational

aspects of networks, show that a certain positioning of companies in their network can enable the network agent to profit from network benefits.

2.4.5 The role of network position and organisation heterogeneity

Seeing organisations embedded in network structures helps to explain resource sharing and KS mechanisms, still it misses the heterogeneity aspect that inherits any organisation. Every organisation is shaped by its capabilities, abilities and structure and is therefore better or less able to access and share knowledge (Saebi and Foss, 2015). Furthermore, it holds a certain position shaped by structural and relational embeddedness, with a number of ties in a very dense or open network. All these differences point out that not every organisation profits the same way of being embedded in network structures and that the ability to share knowledge must depend of many organisational factors. As research on embeddedness has not focused on what single actors can achieve or contribute within the network (Gulati, Lavie and Madhavan, 2011) but rather concentrated on behaviour and outcomes of networks (Gulati, 1998; Gulati, 1999; Gulati, Lavie and Madhavan, 2011; Lavie, 2006) the role of the network agent needs to be stressed. Burt (1992) already pointed out that there must be differences in profiting of networks depending on the position the organisation fulfils within the network. “This overemphasis on the structural or relational properties of networks has led to neglect of heterogeneity in actor and alter attributes” (Gulati, Lavie and Madhavan, 2011, p.210). Network resources are distributed heterogeneously within the network and enable different access to different positions (Gulati, 1999). Therefore, detailed mechanisms of resource flow between single actors need to be investigated further (Corsaro, Cantu and Tonisini, 2012; Gulati, Lavie and Madhavan, 2011).

Networks can produce inimitable resources and information on firm level (McEvily and Zaheer, 1999; Gulati, Nohria and Zaheer, 2000). Firms vary in combination of tie patterns and contacts influenced by company and network structures available (Gulati, Nohria and Zaheer, 2000). Consequently, positioning within network structures considering organisational specifics is essential to facilitate resource exchange (Tsai, 2001; Jarillo, 1988).

This approach requires a view at different network typologies in order to understand where an organisation can be positioned within the network. There can be a central organisation as a strategic centre (Lorenzoni and Baden-Fuller, 1995) or a dedicated alliance function (De Wit and Meyer, 2010) that controls KM and introduces governance mechanisms for KS. A central unit may be able to access knowledge through its network links but may not have sufficient capacity to absorb all knowledge (Tsai, 2001). Detailed considerations are outlined below.

2.4.5.1 The role of central positions

The role of central positions in networks receives great attendance in network research. Central positions seem to offer benefits for resource exchange, information sharing and KS (Arya and Lin, 2007; Galaskiewicz, 1979; Ibarra, 1993; Powell et al., 1996) due to the high number of ties maintained. Still, even though a great number of ties might be beneficial, companies also need to be able to maintain them (Ahuja, 2000).

Additional to that, Arya and Zhiang (2007) argue that company status mediates the ability to maintain central positions emphasising that high status organisations can fulfil central positions as well as having good access to critical resources. Consequently, not every organisation is able to fulfil a central position “similar network positions can extract similar benefits from those positions, yet organizations differ in their abilities to do so” (Gulati, Lavie and Madhavan, 2011, p.210). Companies acting in networks can only access the resources that are available through the ties maintained and the strategy aimed at. Some positions in networks might be superior in KS as they offer a different access to ties (Gulati, 1999; Rowley, Behrens and Krackhardt, 2000; Walker, Shan and Kogut, 1997) but this is only true for companies that aim for that resource access. When the network position support the company strategy it can also influence firm behaviour and outcomes (Ahuja, 2000; Snow, Miles and Coleman, 2000).

Beside the view of a central or focal firm occupying the most nodes and being influential (Adner and Kapoor, 2010; Adner, 2012; Kapoor and Lee 2013) several authors introduced the idea of core and

periphery positions in networks (Hojman and Szeidl, 2008). Not only one organisation but a number of organisations can be located in the core of the network, occupying a central position influenced by cohesive ties and mutual acceptance. Network agents in the periphery are less interrelated but help to access a diverse set of knowledge (McEvily, Soda and Tortoriello, 2014). McEvily, Soda and Tortoriello (2014) also stress that informal and formal patterns of behaviour might or might not overlap, meaning that formal centrality does not necessarily relate to informal centrality. Nevertheless, both could exist at the same time.

Summarising the above, CR can offer additional and new knowledge for organisations being embedded in networks and occupying certain positions. For the organisation positioned in networks, CR have the potential to facilitate KS. In order to understand individual benefits of network agents in regards to resource exchange and KS, certain positions in networks need to be examined more closely (Ahuja, 2000) as well as their ability to maintain or govern relationships.

2.4.6 The role of governance mechanisms in networks

The need for network governance or conscious maintenance of CR evolves from the necessity to benefit from network relations. Depending on relationship type and network environment, agents are more or less collaborative. New knowledge necessary for innovation can often only be accessed by addressing competitors (Zahra and Nambisan, 2012) leading to a paradox of collaboration and competition (De Wit and Meyer, 2010). Additionally, network structures hold the risk of opportunism as there are no such mechanisms as hierarchies (Williamson, 1985) or other bureaucratic mechanisms (Powell, 1990). This makes it even harder to share knowledge and innovate without actually losing competitive advantage to competitors. “When a firm's partners have many connections, the information that reaches the firm through the network also reaches many others, the other partners of its partners. These partners potentially represent competition for the firm in using this information” (Ahuja, 2000, p.431). This paradox can only be overcome when organisations carefully select their partnerships and consider their openness strategically (Hautz, 2017). Being aware of distinct

relationships that can and need to be maintained is essential to create beneficial partnerships (Ahuja, 2000).

As explained above, network structures lack the coordination function that bureaucratic structures such as organisations have (Grant 1996a). As networks are neither market nor hierarchies (Powell, 1990) they have different network governance mechanisms that contrast with market and hierarchy mechanisms (Jones, Hesterly and Borgatti, 1997). Recent research on network governance, often named network orchestration (Batterink et al., 2010), mainly focuses on investigating innovation networks or ecosystems (Hurmelinna-Laukkanen and Nätti, 2017; Scaringella and Radziwon, 2017). The term ecosystem will be discussed later.

As network structures enable organisations to transfer information or act as intermediaries, they provide a certain influence (Brass et al., 2004; Howells, 2006). This influence is named the ability to govern (Jones, Hesterly and Borgatti, 1997) or orchestrate a network (Hurmelinna-Laukkanen and Nätti, 2017). Governance can be defined “as the set of deliberate, purposeful actions undertaken by a focal organization for initiating and managing innovation processes in order to exploit marketplace opportunities, enabling the focal organization and network members to create value (expand the pie) and/or extract value (gain a larger slice of the pie) from the network” (Hurmelinna-Laukkanen and Nätti, 2017, p.2). Regular interaction, management of relations, joint goals and mutual dependency are the basis for network governance (Gulati and Singh, 1998).

The influence of the organisation acting in CR differs by its own governance abilities as well as by network specifics (Jones, Hesterly and Borgatti, 1997; Snow, Miles and Coleman, 2000).

The organisation’s network embeddedness is the basis for the use of informal and formal mechanisms to govern the network (Jones, Hesterly and Borgatti, 1997; Dhanarag and Parkhe, 2006). Some authors stress the importance of informal mechanisms build on social relations (Jones, 1997). Others see the tendency to explain business relationships with social mechanisms as being critical (Gulati, Lavie and Madhavan, 2011). Social relationships and social mechanisms are important to develop ties and governance structures and they are essential for the facilitation of KS, still, interpersonal ties

differ from interorganisational ties (Rowley, Behrens and Krackhardt, 2000; Gulati, Lavie and Madhavan, 2011). Dhanarag and Parkhe (2006) distinguish between formal and informal relations by calling them type of socialisation among agents. Although these relations are governed by formal and informal communication channels they are influenced by distinct mechanisms. Informal relations are shaped by trust, mutuality, frequency of interaction and proximity (Alsharo, Gregg and Ramirez, 2017; Das and Teng, 1998; Pulles and Schiele, 2013) whereas formal relations, strengthened by these aspects as well, have a certain formal control due to contractual dependencies for example (Brass et al., 2004; De Wit and Meyer, 2010; Caimo and Lomi, 2014). In less contractual controlled and more socially embedded networks social interaction acts as a governance mechanism (Rowley, Behrens and Krackhardt, 2000). Formally shaped networks can be for example supply chain networks (Cooper et al., 1997), manufacturing arrangements and joint ventures (Powell, 1990).

The degree of embeddedness also influences governance ability. When companies are interconnected in a deeper way their interactions require less coordination (Powell, 1990). Generally, dense interaction and information flow lead to established norms of cooperation and the closer a network is, the better developed such norms (Rowley, Behrens and Krackhardt, 2000; Walker, Shan and Kogut, 1997). In contrast to that; well-structured and less embedded networks, such as horizontal or vertical structured networks, can better follow a certain aim as well as distribute tasks among members (Inkpen and Tsang, 2005).

In terms of relational embeddedness, strong ties for example can enhance governance as they enable the distributions of norms, as partners are highly interconnected and in often long remaining partnerships (Meyer and Rowan, 1977; Oliver, 1991) which in turn leads to more collaborative behaviour among these partners (Coleman, 1988).

Network governance is also influenced by degree of centrality of the network. A strategic centre (Lorenzoni and Baden-Fuller, 1995) or alliance function (De Wit and Meyer, 2010) can introduce governance mechanisms for KS. Centrality of a firm, often called a hub firm, enhances influence (Dhanarag and Parkhe, 2006). Certain attributes of the hub firm enable it to be at the centre of the

network, for example the relationships maintained (Hurmelinna-Laukkanen and Nätti, 2017). In order to fulfil an orchestrator function knowledge created and shared in the network plays a major role. Being able to influence KS means to be able to maintain the network of relationships (Dhanarag and Parkhe, 2006).

Network structures, organisational ability and consequently network governance is a response to environmental factors such as uncertainty and complexity (Jones, 1997; Nambisan and Sawhney, 2011). These considerations are outlined further in the next section.

2.5 Business ecosystem level

This section gives an overview on BE theory and its agents. As already outlined above, strategic considerations of the individual organisation in network theory is still underrepresented. BEs offer a new approach to CR seeing companies acting in their environment by collaborating with a high variety of possible partners. The ability to share knowledge, create innovative ideas and gain competitive advantage is considered in this section from a BE theory perspective on organisations.

2.5.1 Collaborative relationships and business ecosystems

CR are neither seen as markets nor as hierarchies (Powell, 1990). They are seen as interdependent structures that strongly influence each other (Håkansson and Ford, 2002) as already explained above. BEs as one form of CR are also seen as being located between market and hierarchies (Moore, 2006; Scaringella and Radziwon, 2017). In BE theory the increasing complexity of collaborations due to a high variety of interconnected agents (Williamson and DeMeyer, 2012; Heikkilä and Kuivaniemi, 2012) is faced as well as the influence of environmental (Rong et al., 2010; Adner, Oxley and Silverman, 2013) and complex economic changes on CR (Borgh, Cloudt and Romme, 2012).

Companies aim to collaborate in order to exchange resources and to create innovative ideas, products or strategies (Van de Ven, 1986) and reach competitive advantage (Adner and Kapoor, 2010). Nevertheless, they also face strong challenges when crossing company boundaries (Dyer and Singh, 1998). Depending on the environment the company is in, being stable or less stable (Lawrence and

Lorsch, 1976; Stacey, 1995), ‘low or high velocity’ (Eisenhardt, 1989b, p.543), within ‘smooth or abrupt development’ (Suarez and Lanzolla, 2007, p.384) the challenges differ (Adner and Kapoor, 2010). Adner and Kapoor (2010) see the challenges faced by companies in networks relative to the position of the network in the industry. Furthermore, industry specifics impact CR dynamics. How companies can quickly adapt to a changing environment, gain knowledge and realise innovation as fast as possible, are currently important research subjects in BE research (Williamson and DeMeyer, 2012).

While business network research focuses on the development of relationships and resource capturing, BE theory concentrates on industry and cross industry developments. The changing environment and how to reduce evolving uncertainty is investigated (Borgh, Cloudt and Romme, 2012; Rong and Shi, 2015). Furthermore, network research aims at understanding networks as a whole but the role of the individual organisation remains unclear (Berthod, Grothe-Hammer and Sydow, 2017). In contrast to that, BE theory offers an understanding on what agents exist in CR and how they are influenced by their environment (Peltoniemi, Vuori and Laihonen, 2005).

Consequently, BE theory addresses several continuously upcoming subjects in CR, such as the paradox of collaboration and competition, which is named co-evolution (Peltoniemi, Vuori and Laihonen, 2005), the reaction to a fast changing environment (Adner and Kapoor, 2010), as well as the importance of certain network positions and agents (Iansiti and Levien, 2004a). Company boundaries start to blur in CR and the environment of the organisation becomes essential to the survival of the individual firm (Den Hartigh and Van Asseldonk, 2004).

In order to link BE theory to the above described aspects of CR, the subsequent sections are built up as follows. After a first description of BE theory, important research streams are introduced. As a next step, the structural perspective of BE theory is outlined as well as how it complements and is complemented by network theory. How this can be related to KS in certain network positions is discussed after that, resulting into the creation of a conceptual model.

2.5.1.1 Business ecosystem theory

Today companies need to adapt quickly to changing environments (Rong and Shi, 2015; Hu et al., 2014) by gaining resources such as knowledge. Knowledge accessed can contribute to innovative ideas (Sorenson, Folker and Brigham, 2008). Therefore, questions about the environment, what it has to offer and how the company can operate in it and actively maintain the health of its surrounding (Rong and Shi, 2015) become more important. Different to research on business and social networks, BE theory couples the changing environment with the organisation acting within the ecosystem (Peltoniemi, Vuori and Laihonon, 2005).

The BE terminology is derived from biological systems (Moore, 1993; Moore, 1996) and outlines the interdependency of ecosystem actors within the system performing different roles (Li and Garnsey, 2014). Many authors reproduce either Moore's (1993; 1996) or Iansiti and Levien's (2004a) definitions of BEs (Williamson and DeMeyer, 2012; Adner, 2017; Peltoniemi and Vuori, 2004; Battistella et al., 2013; Brusoni and Prencipe, 2013; Gawer and Cusumano, 2013; Isckia, 2009). Moore's (1996, p.26) defines BEs as "An economic community supported by a foundation of interacting organizations and individuals –the organisms of the business world". Iansiti and Levien (2004a, pp.8-9) refer directly to network analogy "We found that perhaps more than any other type of network, a biological ecosystem provides a powerful analogy for understanding a business network. Like business networks, biological ecosystems are characterized by a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival. And like business network participants, biological species in ecosystems share their fate with each other". Heikkilä and Kuivaniemi (2012) see BEs as well as an advancement of the loosely connected partners, which no longer build up strategies on their own. "The BE perspective offers a new way to obtain a holistic view of the business network and the relationships and mechanisms that are shaping it, while including the roles and strategies of the individual actors that are a part of these networks" (Anggraeni, Den Hartigh and Zegveld, 2007, p.11). Similar to a biological ecosystem the focus of BEs lay on the 'complex system of organisms' or actors as well as their relationships and

how they live and develop (Battistella et al., 2013, p.1194). The analogy to network theory is therefore easy to discover, in particular when authors refer to BEs as communities of supply chain partners, stakeholders, governments and public institutions, customers and financing partners (Moore, 1993; Rong et al., 2010). BE theory therefore offers a new perspective to investigate CR (Rong and Shi, 2015).

Overall, the biological metaphor was introduced to describe the idea of firms acting within, and being dependent on, its environment in order to meet today's challenging demands to the single firm (Rong et al., 2010). BE actors are bound together by a mutual aim or a shared vision (Iansiti and Levien, 2004a). The focus shifts from network structures and their performance towards a focus on the single firm and its influence within those structures (Williamson and DeMeyer, 2012). Firms are seen as interdependent elements (Stead and Stead, 2013; Baldwin, 2012) that co-evolve with each other (Basole, 2009; Moore, 1993; Mäkinen and Dedehayir, 2012). The concepts of interdependency and co-evolution are explained further below.

In this work, building on the considerations outlined before, BEs can be seen as open systems of CR with blurred boundaries in which companies mutually interact with each other in order to exchange resources. Certain actors or agents in BEs follow their strategy while considering their own system dependency and influence. In the following, actors and agents as terms will be used simultaneously as done in most BE literature (Scaringella and Radziwon, 2017). The next subsection gives an insight into BE research streams and foci.

2.5.1.2 Research on business ecosystem theory

BE theory evolved out of different research streams such as studies on organisations and their ecology (Hannan and Freeman, 1977), business network and supply chain theory (Isckia, 2009; Rong et al., 2010), innovation networks (Sawhney and Nambisan, 2007), open innovation (Chesbrough, 2010) and open strategy (Bordreau, 2010; Whittington, Cailluet and Yakis-Douglas, 2011; Hautz, 2017). All these research streams take the same principle of openness to collaboration of the single firm,

actor importance and resource dependency resulting in interdependency between agents as basis of research (Isckia, 2009). Nevertheless, during the past years BE theory has been built on different theoretical constructs approaching different aspects of BE theory. Some of the research is explained below.

Having outlined definitions and main contributing areas to BE theory, the following BE research foci can be identified. BE structure (Adner, 2017), capabilities (Scaringella and Radziwon, 2017), performance, outcome and health (Iansiti and Richards, 2006; Singer, 2009), evolution and life cycle (Rong and Shi, 2015) and ecosystem governance (Sawhney and Nambisan, 2007). Den Hartigh, Tol and Visscher, (2006) concentrated on health measuring and governance. Health is linked to diversity of partners (Iansiti and Richards, 2006), types of relationships, value creation (Battistella et al., 2013; Peltoniemi and Vuori, 2004; Overholm, 2015) and niche creation (Iansiti and Levien, 2004a). Anggraeni, Den Hartigh and Zegveld (2007) identified performance and governance as key research areas of BEs and Rong sees the BE life cycle, the process of fostering the BE as substantial (Rong and Shi, 2015).

Additionally, other ecosystem terminology evolved. Beside BE, innovation ecosystems (Adner, 2006; Valkokari, 2015) knowledge-based ecosystems (Borgh, Cloudt and Romme, 2012) or knowledge ecosystems (Clarysse et al., 2014; Valkokari, 2015), industrial ecosystems (Tsujimoto et al., 2017) as well as entrepreneurial ecosystems (Prahalad, 2010) evolved. In this work BE terminology is used. Findings from other ecosystem research is utilised when they are essential for the understanding of ecosystem dynamics.

BE research takes place on multiple level of analysis. The BE level (Tsujimoto et al., 2017), the network level (Nambisan and Sawhney, 2011; Rong and Shi, 2015; Shang, 2014) the organisational level (Stanczyk, 2017; Peltoniemi and Vuori, 2005; Lu et al., 2014) and the individual level (Nambisan and Baron, 2013; Zahra and Nambisan, 2012). Whereas the individual level is only approached from the entrepreneurial perspective so far (Nambisan and Baron, 2013; Zahra and Nambisan, 2012), organisational level research focuses on innovation leadership (Adner, 2006;

Nambisan and Sawhney, 2011), IT platform leadership or leadership in supply chain focused industries (Gawer and Cusumano, 2008; Tiwana, Konsynski and Bush, 2010; Rong et al., 2013). Very little research has emphasised on the organisation and its strategy (Bosch-Sijtsema and Bosch, 2015; Stead and Stead, 2013; Williamson and DeMeyer, 2012; Iansiti and Levien, 2004a). Due to the complexity of BEs, scholars recommend to approach BEs from a holistic perspective by considering multiple levels of analysis (Rong and Shi, 2015). Consequently, BE structure and architecture are outlined in the following, considering network and agents specifics as well.

2.5.2 Business ecosystem structure

Referring to the structure, researchers see BEs as complex adaptive systems (Peltoniemi and Vuori, 2004) as extended supply chains (Rong et al., 2010; Adner and Kapoor, 2010), business networks or multi-agent systems (Tsujimoto et al., 2017). Iansiti and Levien (2004a) suggest that ecosystem structure consists of relationships among agents, the roles they play and the connections they maintain influencing their position. As positions play a vital role in BEs and network structures to fulfil a certain network or BE strategy, the terminology around relationships, roles, strategy and positions is outlined further below.

Relationships can be built on differing transfers (Adner, 2017). Some authors started with transaction cost theory to explain relationships in BEs seeing formal relations as main binding element (Garnsey and Leong, 2008) but soon realised that this approach is not sufficient to explain the multiple and complex net of diverse partnerships (Fox, 2013). Isckia (2009) underlines this view by pointing out that BEs are slightly different to firm networks. The latter mostly build on outsourcing activities with transaction cost decisions at its core (Isckia, 2009). Whereas BEs are characterised by strong interdependency, not always based on direct relations acting within a net of distinct partners that are of different importance to them (Zheng, Zhang and Du, 2011; Isckia, 2009). The reasons for the building of relationships among actors within a BE are as diverse as the approaches to the theory itself. Similar as in business networks, some see the RBV and the ability to exchange and use resource

between ecosystem agents as one reason for the building of relationships (Williamson and DeMeyer, 2012; Isckia, 2009). Iansiti and Levien (2004a) see knowledge and its exchange as a key resource in BEs. From their perspective, closely knit ecosystems can only be build up when KS is enabled and standardised (Iansiti and Levien, 2004a). A shared vision or idea is situated at the core of relationships of a BE (Battistella et al., 2013). In order to maintain and further develop that shared fate or idea, knowledge exchange and sharing is a key resource within a BE. Iansiti and Levien (2004a) suggest that the balance of relationships, how they are tied to each other, how the ties look like and how exactly the members are dependent on each other, should be investigated further. Relationships of interdependency may be competitive, co-operative, collaborative or co-opetitive (Peltoniemi, 2006). Coopetition means competitive cooperation (Bengtsson and Kock, 2002; Brandenburger and Nalebuff, 2011; Gueguen, Pellegrin-Boucher and Torres, 2006). Agents “compete in gaining market, but at the same time cooperate for the defence, the development and the growing of their ecosystem” (Battistella et al., 2013, p.9). Cooperation between agents is the connecting element that holds the BE together and (Scaringella and Radziwon, 2017) simultaneous competition leads to ecosystem innovation and development (Zahra and Nambisan, 2012). On the basis of the described interdependencies, agents in BEs co-evolve, meaning reciprocal evolvement (Mäkinen and Dedehayir, 2012).

In order to understand why BE actors start to collaborate with each other, influencing their co-evolvement, BE roles, strategies and positions as well as their activities and links are investigated further below.

2.5.2.1 The importance of ecosystem roles

As described above BEs can be seen as CR of loosely coupled actors, following a certain network analogy (Aarikka-Stenroos and Paavo, 2017). When comparing BEs with the biological metaphor it becomes obvious that not all actors can fulfil the same roles or strategies nor can they be situated in the same position of the system (Iansiti and Levien, 2004a). The differentiation of roles, strategies

and positions is outlined in the next section after having identified why companies should be aware of their position and their role within the network or BE they belong to.

Companies can only decide strategically about their strategic movements when they are aware of their environment and its requirements (De Wit and Meyer, 2010). Being aware of the environment means for example being aware of their BE that directly influences the firm's development and its long-term success (Zahra and Nambisan, 2012). This also means that an understanding is needed of where the value is created and how the relationship architecture is built up (Williamson and DeMeyer, 2012). Theory on complex systems also sees the exploration of system properties as a starting point to lift organisations on a higher level of operation (Battistella et al., 2013). Which in turn has an influence on the understanding of cooperation and competition mechanisms in BEs (Isckia, 2009). These aspects will be discussed further below in the BE architecture section. Nevertheless, due to relatively heterogeneous structures in BEs, actors within the ecosystem need to fulfil certain roles in order to enhance and nurture stability and productivity of the whole system (Heikkilä and Kuivaniemi, 2012). Especially as not the complete BE can be controlled and not all actors have the same and sufficient information to enhance actively the whole system. Therefore, it is important for every organisation to understand its role, strategy and position, recognising itself as part of the system in order to act alongside company or systems interests (Peltoniemi, 2006; Håkansson and Ford, 2002; Heikkilä and Kuivaniemi, 2012). As roles, strategies and positions are often used simultaneously, but their interrelation has not been investigated so far (Iansiti and Levien, 2004a; Rong and Shi, 2015; Isckia, 2009), the differences of the terms and their importance for understanding BEs are explained below.

2.5.2.2 Business ecosystem roles

Besides investigating BE structures, some scholars also paid attention to role identification (Moore 1993; Iansiti and Levien 2004b; Den Hartigh and Van Asseldonk 2004; Iyer, Lee and Venkatraman, 2006). Moore (1996) sees BEs as consisting of organisations and individuals and other authors started to introduce certain roles occupied by these agents.

Iansiti and Levien (2002) for example introduced the four key roles being Keystone, Niche, Dominator and Hub landlord. These roles might vary or change over time (Iansiti and Levien, 2004a). They see Keystones as actors that align their interests with BE interests regulating ecosystem survival being embedded in system requirements, rules and connections. Keystones maintain the ecosystem endurance by building up stable platforms of interaction for other network agents (Iansiti and Levien, 2004a). In biological ecosystems the removal of a Keystone species would have disastrous consequences as it maintains the ecosystem health (Power et al., 1996). Therefore, he is frequently named the central player of the BE (Iansiti and Levien, 2004a). Interaction and co-evolution within a BE are often shaped by the Keystone in order to enable other firms to organise their mutual goals and activities (Moore, 1993; Moore, 1996; Sawhney and Nambisan, 2007; Zahra and Nambisan, 2012). Keystones seem to play a vital role for how interconnections are built up, relationships are maintained and structured. They shape the ecosystem by their vision and not by set boundaries (Stead and Stead, 2013). Niche players in turn are often located at the edge of the ecosystem to bring in new ideas and innovations, whereas Dominator and Hub landlords specialise to extract value and resources out of their BEs (Iansiti and Levien, 2002; 2004a; Isckia, 2009; Zahra and Nambisan, 2012).

The roles seem not be fixed to certain network positions but seem to change over time with the evolution of the BE (Rong and Shi, 2015; Shang, 2014). Critiques of the roles explained by Iansiti and Levien (2004a) are that they focus on firm level strategy rather than BE level and that the transformation and evolution of roles has not been investigated (Rong and Shi, 2015). The described ecosystem roles of Iansiti and Levien (2004a) are the typical ecosystem roles (Scaringella and Radziwon, 2017) named frequently in BE research.

Beside the above outlined roles, Rong and Shi (2015, p.227) introduced ‘initiators, specialists and adopters’ investigating BEs from a structural and infrastructural side. Initiators are central firms that set up and build their ecosystem. They are responsible for nurturing it and keeping it healthy. A platform enables the interaction of the initiator with the other partners. Here, niche opportunities can

be displayed for adopters to incorporate or specialists offering extended resources for the BE development (Rong and Shi, 2015). The description of Rong's roles correspond in many details to Den Hartigh and Van Asseldonk's (2004, p.25) roles named the 'shaper, adapter and opportunist'. These roles again are based on Iansiti and Levien's roles (2004a) explained above (Den Hartigh and Asseldonk, 2004). The shaper tries to advance and maintain its own ecosystem by offering access to its own technology. The adapter (Besen and Farrell, 1994; Den Hartigh and Van Asseldonk, 2004) joins the technology offered and develops it further using its own know-how. The opportunist in turn waits for opportunities that come up in order to strengthen its own position at some point of the technology development (Coyne and Subramaniam, 1996; Den Hartigh and Van Asseldonk, 2004). The concept of Iyer, Lee and Venkatraman (2006, p.44) refers to certain network positions such as 'hubs, brokers and bridges' being able to fulfil a Keystone, Niche, Hub landlord or Dominator strategy. The Keystone again is responsible for information exchange and the maintaining of connections between firms, nurturing a platform as key exchange tool (Iansiti and Levien, 2004a) in order to create value within the BE. While Dominator and a Landlord extract value, the Niche player contributes additional value (Iansiti and Levien, 2004a). The broker acts as relation keeper which can be 'liaison, representative, gatekeeper, itinerant broker, and coordinator' (Iyer, Lee and Venkatraman, 2006, p.43-46). The bridge corresponds again to the Niche player or complementor (Iansiti and Levien, 2004a; Iyer, Lee and Venkatraman, 2006; Adner and Kapoor, 2010).

Zahra and Nambisan (2012) differ roles by ecosystem entrance and by company funding. They state that a BE hosts both, 'well-established companies and new ventures' (Zahra and Nambisan, 2012, p.220). New ventures are Niche players coming up to occupy new developed niches and are often superior in terms of KS and learning and quite flexible in their strategic decisions. In contrast to that, well-established companies contain a more comprehensive resource base (Zahra and Nambisan, 2012). Shang (2014) divides a BE in different subsystems to differ the players by their task they fulfil. She found that the subsystems change in structure and density by ecosystem evolution. The same applies to the role of the central player, here named the orchestrator, who is active, integrative or an

authority depending of the development stage and age of the BE (Shang, 2014). Here, the orchestrator is the key driver of the ecosystem building up its own network by fulfilling different actions in different evolutionary stages (Shang, 2014).

Sawhney and Nambisan (2007, p.93) identify the roles of ‘architects, agents, adapters’ as well as the ‘hub firm orchestration’ (Nambisan and Sawhney, 2011, p.40). Again the architect is the one that shapes the ecosystem, whereas agents build up connections, adapters act as complementors and orchestrator control the system (Sawhney and Nambisan, 2007; Nambisan and Sawhney, 2011). They define architects as being platform leaders who triggers for innovation but they also name them orchestrators if they have a strong leading role in a less embedded network with a strong central player. So orchestrators are for them organisations that control other actors of the ecosystems (Nambisan and Sawhney, 2011). Adapters in turn provide specialised knowledge and services and are found not in the central part of the ecosystem but on the edge, bringing in innovation and expertise. Agents mediate interactions and enable KS in order to strengthen the ties of the ecosystem. They are also called ‘innovation capitalists or brokers’ (Sawhney and Nambisan, 2007, pp.63-64).

The orchestrator role explained by Nambisan and Sawhney (2011) fits at some points to the Dominator strategy or the Hub landlord strategy Iansiti and Levien (2004a) describe. Dominators are often physically big and acting as central actors. They eliminate other actors in order to control the system and do not encourage diversity. Consequently, Dominator driven ecosystems are less active, as the Dominator occupies many nodes and maintains many formal relations horizontal and vertical. In comparison to Keystones, Dominators weaken their ecosystem by trying to control all elements to control value creation and distribution (Isckia, 2009). As Dominators want to control even niches, they have a big R&D department in order to investigate on changes in technology (Iansiti and Levien, 2004a). Dominators might be useful for a BE, when innovation speed is low, coordination is required and transaction costs between firms are high. Which is the case in more closed ecosystems such as mature industries. However, controlling and occupying niches does not build the ecosystem health

which makes Dominator driven networks less resilient to shocks (Iansiti and Levien, 2004a; Sawhney and Nambisan, 2007).

Niche players are often the highest number of actors in a BE, and the more exist the higher is normally the value created in that ecosystem (Isckia, 2009). They support the Keystone by value creation and form the majority of ecosystem agents. They generate innovation through niche specialisation (Mäkinen and Dedehayir, 2012).

When summarising the above and the contribution of different authors to BE roles or strategies, it becomes obvious that three key roles are described by every author even though they are given different names. One is the role of the BE driver, being the Keystone, the role that shares value to maintain the ecosystem health and that enhance niche creation and innovation. Another role is the Niche player, who creates value for the BE. The third role is the Dominator who extracts value from the system. As outlined above, the terms of distinct roles companies can play in BEs are used frequently, interchangeably and can overlap in BE research. This can be misleading as it is not always clarified if a role is a company that is characterised in a certain way, or a certain behaviour a company can follow as its strategy. Consequently, the terms of ecosystem roles and strategies have to be clarified for this work.

2.5.2.3 Difference between business ecosystem roles and strategies

Tian et al. (2008, p.105) states that a role is “a set of connected activities and decisions”. In addition, Iansiti and Levien (2004a) introduce the Keystone role as a way companies can behave in network structures. For example a network hub following a Keystone strategy (Iansiti and Levien, 2004a). Other researchers see the roles introduced as classifications of certain companies. A Keystone role means for example being a Keystone company characterised by certain characteristics following a specific strategy (Zahra and Nambisan, 2012; Rong and Shi, 2015; Isckia, 2009). In this work, the roles introduced by Iansiti and Levien (2004a) are used as being the main and repeatedly mentioned roles (Scaringella and Radziwon, 2017). Furthermore, Keystones, Dominators and Niche players are

classified as being certain organisations, which fulfil a set of activities that define them and that shape their strategy. Consequently, a role can be explained by characteristics and activities of network agents that follow a certain strategy. Still, the terminology remains blurred and roles are often named simultaneously with strategies. Strategies followed by BE agents are introduced in the next section.

2.5.2.4 Business ecosystem strategies

As already outlined above, ecosystem roles are often seen as certain strategies followed (Stead and Stead, 2013). Iansiti and Levien (2004a) introduce their roles as being strategies of companies in certain network positions. A Keystone company follows a Keystone strategy (Iansiti and Levien, 2004a). Others see Keystones as following a leadership strategy (Stead and Stead, 2013). Also, they refer to Keystones as platform leader (Cusumano and Gawer, 2002), ecosystem leader (Moore, 1993), orchestrator (Nambisan and Sawhney, 2011) or ecosystem regulator (Mäkinen and Dedehayir, 2012). The term of ecosystem leader can be misleading as Dominators are leaders as well but are following different activities than Keystones. Other than the Dominator, the Keystone wants to grow the ecosystem in a sustainable way (Isckia, 2009; Stead and Stead, 2013). The word leader also implies a certain amount of control, but control is not an important attribute of a Keystone as they rather build on influencing other actors (Mäkinen and Dedehayir, 2012). They grow their ecosystem through interaction and value distribution (Fox, 2013).

In the following, the attributes of the Keystone strategy are introduced further. Other terms such as platform leader, ecosystem leader, orchestrator or ecosystem regulator are considered in that introduction. Additionally, the Niche player and Dominator strategy are outlined as they are important complementors of the Keystone strategy and all agents are highly dependent on each other.

The physical size of a Keystone is relatively small in comparison to other firms within BEs (Iansiti and Levien, 2004a; Mäkinen and Dedehayir, 2012) which also influences his strategy. In order to maintain their connections and be able to distribute value, Keystone often introduce a platform of interaction for all partners of the BE (Isckia, 2009). The distribution of value is not an altruistic

strategy but is done for the purpose of growing the own business together with the BE development (Iansiti and Levien, 2004a; Moore, 1993; Cusumano and Gawer, 2002; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012). Overall, Keystone steered ecosystems are characterised by actors who act in the greatest interest of all members (Isckia, 2009). The platform architecture highly influences the architecture of the ecosystem, this is why a Keystone organisation must consider future changes and challenges of these architectures when enhancing interaction and value sharing (Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012). Ecosystem architecture and platform characteristics and their terminology are outlined further below in more detail.

The ability of providing a platform of interaction is key to the success of a Keystone as it is the tool to enhance others to develop their offerings and distribute them (Mäkinen and Dedehayir, 2012). Especially as one firm alone cannot meet all customer needs and market challenges, the Keystone is dependent on the value shared on its platform (Fox, 2013). He therefore needs to be able to use integration skills and the ability to combine resources to grow the BE (Isckia, 2009). In some terms Keystones follow an open strategy by introducing a platform for interaction between ecosystem agents enhancing open resource and information exchange (Fox, 2013). Nevertheless, it is a great challenge for the driver of the BE to coordinate all relations contributing to the platform (Rong and Shi, 2015), therefore the role of different ties and their contribution comes into consideration. Especially, as not all connections can be considered of the same importance (Scott, 2017).

Additionally, the Keystone regulates the health of the ecosystem (Stead and Stead, 2013). The overall success of the ecosystem depends of the interaction of the individual actors (Iansiti and Levien, 2004a). This means that poor control mechanisms and poor exchange mechanisms that do not enhance the exchange between Niche players bringing in ideas for Keystones, or that do not support the ability of the Keystone to communicate its needs, can harm the health of a BE (Iansiti and Levien, 2004a; Fox, 2013; Mäkinen and Dedehayir, 2012). It is therefore essential, that governance mechanisms are in place supporting the activities in the BE. Hence, the role of governance mechanisms will be discussed further below.

Keystones follow a strategy of value creation (Isckia, 2009) that takes place when players share their resources (Scaringella and Radziwon, 2017). The exchange of resources to create value is vital to keep the ecosystem healthy but also to attract new players to the ecosystem and enhance its development (Moore, 1993). Value creation can take place as follows: “a series of assets that can be easily scaled and shared by a broad network of business partners. These assets may be physical, as in the case of a large and highly efficient manufacturing network; intellectual, as in the case of a broadly available software platform; or financial, as in the case of a venture capitalists’ portfolio of investments” (Iansiti and Levien, 2004a, p.92).

As explained above, value creation results from relationship building and this can take place for several reasons such as leveraging resources, integrating activities or for lobbyism (De Wit and Meyer, 2010). These relations are not always typical transactions or formal contracts but also other legitimate behaviour such as unwritten and written code of conduct, or frequency of interaction, or power (De Wit and Meyer, 2010). Not all of the relations can be maintained by control, as some of them might be informal and most of them take place outside of traditional market or hierarchy structures (Powell, 1990). Exchange is influenced by competition and collaboration at the same time (Den Hartigh and Asseldonk, 2004; Iansiti and Levien, 2004a). The Keystone needs to consider what information it can give away easily. Especially, as they can as well be threatened by an upcoming Keystone within the BE (Isckia, 2009) or by value extraction of the Dominator (Stead and Stead, 2013). On the other hand, Keystones can keep their partners by sharing competitive information as this can enhance the development of capabilities among partners (Anggraeni, Den Hartigh and Zegveld, 2007; Isckia, 2009). That also strengthens the own position by implementing the service offered by ecosystem partners and therefore increasing dependency among ecosystem members (Power et al., 1996). Keystones therefore mainly profit from their strategy themselves. Meaning they fulfil the Keystone strategy on purpose and build up their ecosystem consciously rather than being just an ecologically determined actor. This is manifested by the intelligence of relations (Isckia 2009) and the awareness of the potential value new partners can offer (Kirby and Stewart, 2007). This also

explains why Keystone positions can be identified by going back the ecosystem evolution history influencing the development of the ecosystem (Heikkilä and Kuivaniemi, 2012), as building relations is path dependent (Håkansson and Ford, 2002).

Keystones are not important without the Niche players as they are responsible to create value by bringing in new ideas that correspond to the challenges of the ecosystem environment (Iansiti and Levien, 2004a) such as industrial changes (Rong et al., 2015). Isckia (2009) sees core competencies (Hamel and Prahalad, 1990; 1994) at the core of each player of the BE as they form the expertise and integration skills that are needed to create value on the Keystone platform supporting Teece (2007) notion of capability development.

Another very important strategy followed in a BE is the role of the complementor (Iansiti and Levien, 2004a; Iyer, Lee and Venkatraman, 2006; Adner and Kapoor, 2010) the adapter (Sawhney and Nambisan, 2007; Den Hartigh and Asseldonk, 2007), bridge (Iyer, Lee and Venkatraman, 2006) or Niche player (Iansiti and Levien, 2004a; Mäkinen, Dedehayir 2012). “Whether in biological or BEs, Niche players have specialized functions which can contribute toward the holistic function of the ecosystem. Their specialization also helps them differentiate from other members of the ecosystem” (Mäkinen and Dedehayir, 2012, p.3). Some Niche players build up their own BE when a niche develops further to a greater market and the innovation started by the Niche player in the first place becomes more established (Garnsey and Leong, 2008). In that case the development from a Niche player to a Keystone is possible. Niche players can be loosely coupled (Iansiti and Levien, 2004a) which means that they provide their technologies and know-how to a number of different BEs to distribute their own risk (Tiwana, Konsynski and Bush, 2010). With their contributions they further develop the BE (Rong and Shi, 2015). They are not always completely depended to one Keystone which might lead to tensions between Keystones of different BEs (Mäkinen and Dedehayir, 2012). Consequently, Niche players might get quite powerful through connecting to different ecosystems and Keystones especially when they are loosely coupled. This enables flexibility and negotiating power (Iansiti and Levien, 2004a). These actions make sense to the Niche player as they invest their

resources to meet the requirements of the Keystone's ecosystem and are therefore dependent on the success of the innovation provided (Adner and Kapoor, 2010). They can leave Keystones and their BE when they are trying to extract too much value for the Dominator (Iansiti and Levien, 2004a). Additionally, Niche players compete within their own sub-industry in order to be able to offer the better product (Mäkinen and Dedehayir, 2012). This competition enhances again value creation and contributes to BE survival.

The third important role is the one of the Dominator that follows a value extraction strategy by physical domination (Isckia, 2009; Iansiti and Levien, 2004a). They are aiming at maximum benefits in a short time (Stead and Stead, 2013) but can also create a high amount of value themselves (Iansiti and Levien, 2004a). Although, the description of the strategies are conceptually detailed, they are not investigated empirically in-depth so far. Additionally, the interplay between the agents remains underrepresented (Iansiti and Levien, 2004b), as well as the methodological proof of the descriptions provided (Scaringella and Radziwon, 2017).

Having outlined the three key strategies, the **Table 2.2** shows a detailed description of Iansiti and Levien's (2004a) strategies and roles, used simultaneously, in BEs. The hub landlord strategy has been elided as it has not been as repeatedly mentioned in literature. The other three key strategies are taken as the main ecosystem strategies (Scaringella and Radziwon, 2017).

Even though several BE strategies of ecosystem agents have been introduced, and although Moore (1993) defines actors in BEs as being organisations or individuals forming the business world, no attempt has been made so far to link a BE strategy to a certain company or business unit strategy. Although, authors state that for example Keystones do not follow their strategy due to altruistic reasons (Iansiti and Levien, 2004a; Moore, 1993; Cusumano and Gawer, 2002; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012), it remains unclear what drives them on company or even individual level.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Table 2.2: Description of strategies and roles in business ecosystems

(Source: Iansiti and Levien, 2004a)

2.5.2.5 Difference between business ecosystem roles and positions

Positions are defined through activities, for example ‘who hands off to whom’ (Adner, 2017, p.43), locating the actors in the system or as resulting from relations maintained, building on these activities. As there are asymmetries in network position concerning the ability to access resources, create value or maintain connections there need to be a difference between certain positions and strategies that can be fulfilled on that positions (Adner and Kapoor, 2010). Although authors often refer to roles and positions simultaneously, not all central players automatically play a beneficial role (Iansiti and Levien, 2004a) and decentralised or totally embedded networks might not even have a central player but consist of multiple actors (Quaadgras, 2005). Adner and Kapoor (2010) see the focal firm and the complementary firms as the two main roles within BEs being also related to a network positions (Adner, 2012; Kapoor and Lee 2013). Iyer (2006) for example, proposed three roles called hub, broker and bridge that follow possible strategies of Keystone, Dominator and Niche (Iyer, Lee and Venkatraman, 2006). Iyers description of the different roles also refer to a position. Here, the hub firm provides an augmented number of links in comparison to size, a broker a firm sets up connections between firms, being situated in between firms, and a bridge, that creates links to all firms within the

network (Iyer, Lee and Venkatraman, 2006). Positions, such as for example the position of a hub, are well explained in network theory. A hub is placed in a central position of the network, maintaining a high numbers of links and having a certain linkage and information advantage (Adner and Kapoor, 2010; Battistella et al., 2013). In network theory centralisation is defined by the concentration of links around a focal point (Freeman, 1978) that is why hubs are also often called focal companies (Scott, 2017). Therefore a hub or focal point is located in a central position within the network as it has more connections to network members than the other firms in the network so its central positions is relative to the other members (Arya, 2007). The focal firm can then decide to play a Dominator role or a Keystone or even a Niche player role, when it is building up its ecosystem (Shang, 2014).

Central or focal firms are often seen as drivers (Iansiti and Levien 2004a; Adner and Kapoor, 2010; Gawer and Cusumano 2014; Rong and Shi, 2015) for the network. Generally, hubs can gain a lot of advantages out of their position as they are connected to the most nodes within the system which can make them to an enormously influential player (Iansiti and Levien, 2004a). Naturally, the connections also increase the complexity, coordination and integration requirements (Scott, 2017) for the central player when productivity should be increased (Iansiti and Levien, 2004a) or information be used (Galaskiewicz, 1979; 1985). Some hubs, as the often-cited Wal-Mart example, are able to maintain a platform to share and distribute products that enable the company to be successful due to its unique position (Iansiti and Levien, 2004a). The strategy Wal-Mart followed was using its hub position to grow the whole network of CR which was referred to as Keystone strategy. Meaning that the company took care not only of its own development but also of the development of all ecosystem members trying to keep the whole system healthy (Mäkinen and Dedehayir, 2012).

Bridging and brokering firms are described by Iyer, Lee and Venkatraman, (2006) as companies that bridge firms to other firms in the network using interfirm linkages. This concept reminds of bridging ties within networks that are linking firms to important circles hardly accessible to the focal firm (McEvily and Zaheer, 1999) and that can span structural holes and bring in new ideas and information (Burt, 1992). Bridging ties are in a spatial location, located more at the edge of the network (McEvily

and Zaheer, 1999) which fits to the role of a Niche player. They bring in new ideas of the edge of the ecosystem by occupying a certain position in the BE (Iansiti and Levien, 2004a). Not every bridging firm might play the role of a Niche player, consequently there is a distinction between position, strategy and roles in BE that needs to be clarified further. Nevertheless, bridges can contribute to effective networks as they build up concentrated networks and connect distinct network components and enable facilitated resource exchange (Uzzi and Spiro, 2004; Burt, 1992). They create short cuts small distances between different networks (Watts and Strogatz, 1998; Brass et al., 2004). However and summarising the above, firms occupying central or edge positions within networks can fulfil different roles (Iansiti and Levien, 2004a; Fox, 2013) to which some authors refer to as strategies (Iyer, Lee and Venkatraman, 2006).

2.5.2.6 Business ecosystem agent characteristics and capabilities

As already outlined above, the terms roles, strategies and positions are often named simultaneously leading to a blurred understanding of the characterisation of a BE role. Characteristics and actions of agents might contribute to an understanding of Keystone roles and also as they fulfil a certain strategy. Actions are important to understand strategies undertaken as “strategizing” refers to the ‘doing of strategy’; that is, the construction of this flow of activity through the actions and interactions of multiple actors and the practices that they draw upon” (Jarzabkowski, Balogun and Seidl, 2007, p.584). Actions are key elements of strategy making. Still, actions are not only the basis for strategy when there are referring directly to strategy but other actions can be strategically relevant (Jarzabkowski and Spee, 2009). Also characteristics of the individual, and the company the individual acts in (Brass et al., 2004; Grant and Baden-Fuller, 2004), and bundles of actions are important to understand (Grant, 1996a; Gulati, Lavie and Madhavan, 2011; Schatzki, 2011; Lane, Salk and Lyles, 2001). Characteristics are defined as being “a feature or quality belonging typically to a person, place, or thing and serving to identify them” (Oxford Dictionary I, 2018) and actions are “the fact or process of doing something, typically to achieve an aim” (Oxford Dictionary II, 2018). As characteristics and

actions are very broad terms, only characteristics and actions that are strategically relevant or relevant to understand the Keystone role are considered in this research. Action cannot be separated from characteristics, as for example leadership characteristics shape activities undertaken (Mintzberg and Waters, 1985). In order to better understand BE agents, such as Keystones, Niche players or Dominators a structured approach to their activities leading to strategies, their positions and links is necessary.

Therefore, in the following **Table 2.3**, a structured approach introduced by Adner (2017) to investigate BEs was used to cluster current Keystone contributions. To do so, the 18 contributions of Keystones sampled in the third literature review step were allocated to his dimensions to analyse BE's (based on the data collection process in Appendix A) Adner (2017) differs between BE actors, activities, positions and links, which will be used here to provide a first description of agent characteristics based on current literature. Additional to these four components, the strategy followed by the agent will also be considered, seeing activities undertaken to enable the strategy fulfilment. Actors may undertake single or multiple activities (Adner, 2017).

Table 2.3 lists all actor names for the Keystone, his strategy, position and links that were mentioned in BE literature so far. Only authors were considered that mentioned Keystones explicitly and that described the role in business, industrial or innovation ecosystems. **Table 2.3** is complemented by **Table 2.4** who list all activities mentioned by the respective authors. Both tables together aim to give a first description of Keystone characteristics mentioned in literature so far.

Author	Actor	Strategy	Position	Link
Stead and Stead (2013)	Keystone Ecosystem leader	enhances value sharing providing sustained competitive advantages for their own firms	serve as a hub in a network	couples with Niche player for value creation
Iansiti and Levien (2004a); Iansiti and Levien (2004b); Iansiti and Levien (2004c)	Keystone	value sharing to maintain ecosystem health Value Creation strategy Keystone strategy independent from industry environment They leave the vast majority of value creation to others in the ecosystem strategy depends on what company it wants to be and in what context it is in	network hub keystones do not occupy a large number of the nodes conspicuous presence	couples with Niche player for value creation often displace or hold in check other species that would otherwise dominate the system removes other species to increase ecosystem productivity
Scaringella and Radziwon (2017)	Keystone, Orchestrator	create a strategy that coordinates the knowledge flows and accounts for all the challenges in collaborative networks	firmly established in the network a position to develop and maintain the ecosystem	many connections
Clarysse et al. (2014)	Keystone	value creation and sharing	can be in a central position	large, established companies that provide key resources and commercial infrastructures to the different ecosystem niches
Isckia (2009)	Keystone, Hub	leadership strategy platform strategies that provide an opportunity to take advantage of the other network actors' contributions	not try to control the whole network and its actors, but rather positions itself on a few nodes and assumes leadership	needs other agents as complementary product/service providers encourage niche players to remain faithful
Rong and Shi (2015); Rong et al. (2015)	Keystone	value creation and sharing	focal firm	involve the Niche players' contribution
Zahra and Nambisan (2012)	Keystone	innovation leader centralised leader knowledge leader	central node that connects participants	connections depends BE structure
Lee et al. (2017)	Knowledge Keystone	brokerage strategy	highest degree of centrality	connected across different groups
Den Hartigh and Van Asseldonk (2004)	Keystone, Shaper	shaper of strategy that helps the company to prosper. Shaper can be Keystone or dominator	hub	connects all other agents
Iyer, Lee and Venkatraman (2016)	Keystone	Keystone strategy	hub	n/a
Zhang and Liang (2016)	Keystone	Keystone strategy can be defined as a strategy that proactively shapes an innovation network	ecosystem hub	connects with other agents to enable activities

Author	Actor	Strategy	Position	Link
Majava et al. (2016)	Keystone	lead actor, platform leader, Keystone strategy	n/a	n/a
Nambisan and Sawhney (2011)	Orchestrator, Keystone, Hub	innovation platform leader	Integrator or hub	connected with other agents through platform maintenance
Kang and Downing (2015)	Keystone, Hub	value sharing strategy	hub	integrally connected; occupying positions of structural importance for the transfer of value through the network
Bosch-Sijtsema and Bosch (2015)	Keystone	collaboration strategy	central firm of an ecosystem	strategically designed management of relationships symbiosis relationship with the other parties engages with Niche player to get complementor to own ideas

Table 2.3: Structured description of the Keystone agent

Author	Activities																	
	BE level															Organisation level		
	platform create hub	structuring ecosystem	regulate access	encourages diversity	enhances productivity	enhances interaction	creates rules & standards	enables niche and value	enables value sharing	Influences/ reacts to change	enables innovation	enables sharing and balancing of know-how	keeps technology standard up to date	shapes ecosystem vision	maintains ecosystem health	adapt organisation	Organisation learning	sustainable strategy
Stead and Stead (2013)	x	x												x				
Iansiti and Levien (2004a); (2004b); (2004c)	x				x	x	X	x		x	x	x	x		x			
Scaringella and Radziwon (2017)		x				x				x								
Clarysse et al. (2014)	x	x										x			x			
Isckia (2009)	x	x			x	x			x				x	x				
Rong, Shi, and Yu (2013); Rong et al. (2015)	x			x		x		x							x			
Zahra and Nambisan (2012)	x		x				x			x	x		x			x	x	
Lee et al. (2017)		x				x						x						x
Den Hartigh and Van Asseldonk (2004)	x					x							x		x		x	x
Iyer, Lee and Venkatraman (2016)	x	x				x	x	x	x		x				x			
Zhang and Liang (2016)	x	x				x			x				x		x			
Majava et al. (2016)							x	x		x			x	x				
Nambisan and Sawhney (2011)	x	x					x	x	x		x		x					
Kang and Downing (2015)						x	x	x	x						x			
Bosch-Sijtsema and Bosch (2015)	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x
Number of nomination	11	9	2	2	3	10	7	7	6	5	5	3	7	4	8	1	3	3

Table 2.4: Structured description of Keystone agent activities

After having reflected opinions of different author's on Keystone activities, building the foundation of a first structured Keystone description, still an empirically conducted as well as scientifically proofed structured description of the Keystone role remains necessary.

So far, keystones have mainly been researched in a structured way when referring to their capabilities (Shang, 2014). Shang (2014) investigated BE capabilities and at the same time introduced some orchestrator capabilities on agent level. She found that different influencing factors in every evolution stage lead to different capabilities for the ecosystem and as well for the single players such as the central firm. She also found that some BE capabilities of the central firm change from one development stage of the BE to the other. The central firm fulfils certain key capabilities in every stage of the ecosystem development and also needs BE dynamic capabilities to develop the ecosystem from one stage to another (Shang, 2014).

The following capabilities and dynamic capabilities of Keystone agents or BE orchestrators have been developed by Shang (2014) explaining different capabilities in different life cycle stages of the ecosystem shown in **Figure 2.4**. All these different orchestrator capabilities display the ability of the ecosystem driver to share and distribute knowledge among its members in order to build up and grow it.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.4: Orchestrator capabilities

(Source: Shang, 2014)

Overall, even though agent or actor roles, strategies and positions in CR are outlined in BE theory, the detailed description of characteristics and actions as well as a clear differentiation between roles,

positions and strategies of certain agents been investigated empirically in-depth so far. Most of the work introduced on the description of agents is conceptual, as already explained above.

2.5.3 Business ecosystem architecture and governance

2.5.3.1 Business ecosystem architecture and platform

Additional to the confusing and overlapping terminology around BE agents, the terminology referring to ecosystem architecture is complex as well. BE research is influenced by many research streams, such as the industry ecosystem, the innovation as well as knowledge, business and entrepreneur ecosystem (Scaringella and Radziwon, 2017) all using slightly different terms. In this work ecosystem architecture is defined from a business perspective, only introducing adjacent terms when a differentiation or comparison is required.

BE architecture is the architectural design that connects ecosystem members with each other (Mäkinen and Dedehayir, 2012). This means in more detail, that BE actors are bound to each other by resource exchange such as for example knowledge flows as well as by the development of shared value (Iansiti and Levien, 2004d; Moore, 1993; Peltoniemi and Vuori, 2004). The community in a BE co-evolves and is centred on a shared vision or idea. Due to actor heterogeneity every ecosystem agent brings in distinct resources. By bringing in the resources following a certain strategy, being to compete or to cooperate, a community of interdependence evolves (Stead and Stead, 2013). Consequently, actors being involved in a BE of a shared vision or idea, influence the ecosystem architecture. Additional to the importance of actor involvement, the industry or industries the BE is in also shapes its architecture. Depending on the environment being complex and uncertain or stable and predictable (Iansiti and Levien, 2004c), actors behave and connect differently to each other and create greater or smaller interdependencies. For example in emerging and upcoming industries, new ideas or new technologies need to be established successfully (Battistella et al., 2013; Rong and Shi, 2015). Here, the ecosystem architecture varies by strength of partners in this technology (Nambisan and Sawhney, 2011). In stable or mature industries resources exchange is already set by a certain path

dependency and structures are settled (Nambisan and Sawhney, 2011; Iansiti and Levien, 2004a). Due to the interdependence between industry, ecosystem architecture and the single actor, a change in the BE environment can also affect the requirements for the actors in it (Peltoniemi, 2006) and a change of involved agents can influence the ecosystem architecture (Nambisan and Sawhney, 2011). Especially in information systems research (Tiwana, Konsynski and Bush, 2010), production research (Gawer and Cusumano, 2014) and technology management on BE (Rong et al., 2013) the term platform architecture has been introduced. “Platforms correspond to open architectures that enable members of an ecosystem to access resources and use them to develop new services that may interact with those already available on the same platform” (Isckia, 2009, p.334). For Isckia (2009, p 335), platforms are ‘technological infrastructures’ that connect ecosystem agents and influence the relationships and the value distribution. Especially platform terminology is shaped by technological terms, which are used here as well to explain the nature of ecosystem platforms. Even though platforms are defined as being ‘platform of services, tools or technologies’ that others used to prosper (Iansiti and Levien 2004c, p.1), the element of interaction is prerequisite to all explanations of platforms. In this work, platforms are therefore identified as being platforms for interaction which can develop through direct or indirect interaction. These platforms can be supported by technology solutions. Through these platforms of interactions the evolution of the ecosystem can be governed or influenced (Stead and Stead, 2013). Especially Keystone organisations set up platform architectures, governed by rules and standards in order to consider future developments (Stead and Stead, 2013; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012). Consequently, platforms enable actors, such as for example the Keystone organisation, to influence or govern the dynamics of the BE as they enable them to interact with other agents of the system (Den Hartigh and Asseldonk, 2004; Iansiti and Levien, 2004a).

2.5.3.2 Business ecosystem platform governance

As introduced above, platforms are shaped by actor relationships based on interaction. The nature of relationship between those actors (Isckia, 2009) is affected by internal and external influencing factors. For example, the degree of interdependency and co-evolution between actors (Stead and Stead, 2013), the architecture of the platform being open or closed for new agents (Isckia, 2009; Rong and Shi, 2015), ecosystem boundaries defined by the platform of interaction (Iansiti and Levien, 2004a; Heikkilä and Kuivaniemi, 2012; Den Hartigh and Asseldonk, 2004), diversity of actors, complexity of developments and uncertainty of the industry can influence how the BE and its platform evolve (Rong et al., 2013; Rong and Shi, 2015; Shang, 2014). In the following, these factors are explained in more detail as well as how they impact the ability to influence BE and platform development from an agent perspective.

As already outlined above, BE theory as a research stream evolved to understand an organisations broader environment of CR (Peltoniemi, Vuori and Laihonon, 2005). The broad approach seeing organisations embedded in a complex system of relations (Peltoniemi and Vuori, 2004) also stresses the importance of other structures of CR such as networks or supply chains as adjacent concepts (Rong and Shi, 2015). In a BE the shared vision or idea plays an essential role why companies come together to collaborate around a certain market opportunity (Zahra and Nambisan, 2012). Because of the shared interest, the shared fate (Iansiti and Levien, 2004a) there is as strong interdependency between ecosystem agents that is shaped by joint co-evolution (Majava et al., 2016) based on collaboration or competition.

In order to enhance innovation and a certain competition among ecosystem agents, the variety of agents is important (Majava et al., 2016). “Perhaps the major difference between the concepts of BEs and business networks is in the variety of actors (...) BEs, in turn, include partners and subcontractors but also complementors, competitors, customers, and potential collaborator companies, as well as public bodies, local incubators, investors, and even research institutes and universities” (Heikkilä and Kuivaniemi, 2012, p.2). Furthermore, external diversity is an essential factor for firm cooperation in

CR in order to decrease the complexity for the individual firm (Peltoniemi, Vuori and Laihonon, 2005) when facing future challenges. Therefore the degree of ‘interconnectedness, competition, cooperation and adaptation’ (Peltoniemi, Vuori and Laihonon, 2005, p.1) is very important and is depending on the diversity of the environment of the BE (Peltoniemi, Vuori and Laihonon, 2005).

BEs with a heterogeneous structure are advantageous when companies try to gain complex knowledge (Heikkilä and Kuivaniemi, 2012) as diversity is essential for diversity of information and innovation (Saebi and Foss, 2015).

Due to the purpose of BEs to deal with uncertain business environments (Moore, 1993) by understanding BE agents being grouped around a shared vision or idea (Iansiti and Levien, 2004a) platform management or governance is a possibility to organise and influence actors in a BE (Rong et al., 2013). Reducing uncertainty by building a platform of interaction can help ecosystem agents to collaborate and co-evolve by joint capability building (Stead and Stead, 2013; Moore, 1996; Mäkinen and Dedehayir, 2012). Especially as perceived uncertainty in industries can hinder innovation in early stages of innovation, a great stock of knowledge can help to reduce uncertainty (Meijer, Hekkert and Koppenjan, 2007; Matusik and Fitza, 2012). This paradox of collaboration and competition (De Wit and Meyer, 2010) in a network of loosely connected entities, being not completely independent from each other (Jarillo, 1988) would lead to a possible loss of information to competitors (Ahuja, 2000). Rong (2015) as well sees interoperability, the ability to collaborate, and the reduction of uncertainty by platform management as core challenges in today’s industry. He states that among all theories around cooperating firms, BEs can best meet this modern requirements. In order to steer uncertainty and complexity, governance mechanisms for BE and platform development are outlined below.

BE governance means not only the aim of certain members to reach leadership and control (Moore, 1998) but also ability of the BE to react and adapt to its environment (Mäkinen and Dedehayir, 2012). Lending a technologically shaped definition, BE governance is “the amount of decision making and control (or coordination) that platform owners should relinquish to other members of the same

ecosystem” (Tiwana, Konsynski and Bush, 2010 cited in Mäkinen and Dedehayir, 2012, p.5). The term platform owner is related to a technical platform and is substituted in this work by platform leader. The role of the platform or ecosystem leader for BE governance is explained in the next section.

As shortly outlined at the beginning of this section, certain influencing factors can be used as governance mechanisms to influence BE development. A central factor to business governance is the exchange platform of the ecosystem maintained by the ecosystem leader, which can be the Keystone (Iansiti and Levien, 2004a; Mäkinen and Dedehayir, 2012; Rong et al., 2010; Rong and Shi, 2015; Den Hartigh, Tol and Visscher, 2006; Isckia, 2009; Quaadgras, 2005). As BEs are often defined as loosely coupled networks, it is essential for the platform leader to be aware of BE mechanisms and abilities to interact and work efficiently and effectively (Rong et al., 2010).

Besides the importance of relationships maintained, as already outlined in the network section of this chapter, the architecture of the platform, its relationships and access are important elements to influence BE development. Relationships maintained directly influence BE architecture, as not all relationships are built on formal relations and cannot be maintained by hierarchy or control (Powell, 1990; De Wit and Meyer, 2010). Nevertheless, platform leaders can try to influence BE architecture by influencing for example the relationship type being based on formalities or informalities, or on collaboration or competition. How in detail the platform leader can influence platform architecture remains unclear (Mäkinen and Dedehayir, 2012) in BEs. Even though the idea of modulating or governing platforms comes from a technology terminology again, BE leaders are known to use that governance mechanism, too (Isckia, 2009). Still, details of mechanisms they use remains ambiguous. Another possibility of modulating the BE architecture is to regulate its platform access. In order to enable diversity, outsiders can either access the platform meaning a certain control loss (Bordreau, 2010) or the platform remains closed to new agents enabling a higher influence (Moore, 2006).

As BE boundaries are blurred and cannot be precisely delineated (Iansiti and Levien, 2004a; Heikkilä and Kuivaniemi, 2012; Den Hartigh and Asseldonk, 2004), the BE platform as exchange platform becomes even more important.

Joint aim orientation can help to influence BE agents (Stead and Stead, 2013), whereas knowledge seems to be an important resource to enable a mutual aim development. The platform is therefore an important KS hub for industry information between agents (Shang, 2014).

The degree of influence on platform development also depends on the relative position (Arya, 2007) of the governing actor. Some authors stress the importance of a central actor at this place, steering the ability of other members to co-evolve, being central to the exchange and alignment of goals and activities and to orchestrate the co-specialisation (Moore, 1993; Moore, 1996; Sawhney and Nambisan, 2007; Zahra and Nambisan, 2012). Consequently, the higher the centrality of the actor the higher amount of decision making that can take place and the amount of control or influence that is possible (Mäkinen and Dedehayir, 2012).

Summarising the above, very little is known about governance mechanisms in BEs and how they are used systematically (Azzam et al., 2016; Jacobides, Cennamo and Gawer, 2018) by certain agents. Therefore, the single organisation being embedded in a certain BE environment and its influence on BE architecture, platform and other agents using governance mechanisms to fulfil its strategy (Iyer, Lee and Venkatraman, 2006) is outlined in the next section.

2.5.4 Governance and knowledge sharing as conceptual model

In BE theory, researchers view is on the one hand on the industry level seeing the environment as being the most important factor determining the action of different actors in a BE (Rong and Shi, 2015; Adner and Kapoor, 2010; Peltoniemi, 2006). On the other hand the role of certain agents becomes important in order to understand how BE development can be influenced (Iansiti and Levien, 2004a; Sawhney and Nambisan, 2007; Tiwana, Konsynski and Bush, 2010).

Companies act different in a stable environment than in an unstable environment, as their relationships might change faster or less fast, being determined by more formal or informal relations. Mechanistic and hierarchical organisations can be found in environments of control, an organic organisation type is better able to adapt to sudden changes (Roffe, 1999). These sudden changes and unstable settings can create an uncertain environment (Eisenhardt and Santos, 2001) or can at least increase the perceived uncertainty (Meijer, Hekkert and Koppenjan, 2007).

BE theory couples the changing environment with the organisation acting within the ecosystem, which means that external variety within the ecosystem environment also leads to diversity within the structure of the network and the individual organisation (Peltoniemi, Vuori and Laihonen, 2005). Nevertheless, only a few BE researcher link mechanisms of BE architecture and the role of BE agents to each other to understand how BEs can be influenced or how the role is influenced by the BE.

Iansiti and Levien (2004c) started a first attempt by introducing the idea of matching the agent strategy to the environment, suggesting that the company itself is influenced on the one hand by the company it aims to be and on the other hand the company it can be due to contextual constraints (Iansiti and Levien, 2004c). Under these circumstances the environment is essential to adjust strategy and reach a strategic fit (De Wit and Meyer, 2010) to fulfil a certain role (Jacobides, Cennamo and Gawer, 2018). While Iansiti and Levien (2004c) follow a firm centric perspective, Sawhney and Nambisan (2007) introduced an innovation ecosystem perspective by considering what architectures enable which strategies of the single agent.

In the following their concept is contrasted with other BE and network theory concepts. It is then further developed towards a conceptual model considering the influence of the single agent depending on the environment he acts in and the knowledge sharing mechanisms available. This model is used to explain important connections and mechanisms outlined in this literature review. Conceptual models outline interrelations providing a less complex display of the reality (Gemino and Wand, 2004).

First of all, Nambisan and Sawhney's (2011; 2007) model is introduced. They refer to different ecosystem architectures depending on the degree of leadership fulfilled in the ecosystem. A central leader has distinct influencing mechanisms than a less central leader. Centrality differs by network structure being more or less embedded. These considerations go along BE and network governance aspects outlined above. Den Hartigh and Van Asseldonk (2004) argue that the influence of network structures and network architectures, such as the role of a central entity, is essential to understand the ability to innovate in CR.

As BE relations are centred around a shared vision, faith or idea (Iansiti and Levien, 2004a) as well as networks around a certain aim (Grant and Baden-Fuller, 2004), Nambisan and Sawhney's (2011) framework supports this essential element to understand CR structures by seeing their network as centred around an innovation aim. Gueguen and Isckia (2011) support this view by seeing innovation as an important shared vision between actors of a BE. They differ between the innovation space being defined or emergent within the respective network structure. This is influenced by the industry the network is in (Sawhney and Nambisan, 2007) shaping the platform of exchange being more or less open to new entrants (Nambisan and Sawhney, 2011). Rong and Shi (2015) follow a similar view by considering evolutionary aspects. Differing between platform openness and solution diversity they refer to the degree of influence and the scope of communication. Depending on the maturing stage of the BE, the platform openness and diversity changes which in turn influences the behaviour and influence of the core firm. Rong and Shi (2015) explain BE changes from an evolutionary perspective, by referring to changing positions of the core firm depending on its relations, diversity gained and the openness of the BE platform. This corresponds to a change of relationships and KM mechanisms available depending on environmental pressures, as discussed in the sections above.

Corresponding to BE theory, Sawhney and Nambisan (2007) also emphasize the fact that specific abilities are required by certain organisations to meet network requirements of network leadership or demands of the BE environment (Sawhney and Nambisan, 2007). They concentrate on the centrality

of the network agent defining its role or strategy as being depended on possibilities of the architecture they act in without investigating their role or strategy in more detail.

Figure 2.5 is displayed to show interdependencies between innovation space and leadership ability and is adapted directly from Sawhney and Nambisan (2007) building the basis for the development of distinct innovation ecosystem architectures explained in **Figure 2.6**. Interrelations displayed here are later used for the own conceptual model in **Figure 2.8**.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.5: Dimensions of network-centric innovation

(Source: Sawhney and Nambisan, 2007, p.81)

Figure 2.5 describes the interdependence of innovation space and network leadership, showing that two opposite views developed which interrelate with each other (Sawhney and Nambisan, 2007) influencing the openness of the innovation exchange platform.

Therefore, the role of the central actor and its possible influence is key within the framework of Sawhney and Nambisan (2007). Depending on its goals in terms of innovation and development of its own firm, the central actor behaves differently and varies his influence in the network maintaining a strong or less strong leadership role. The more control the driver of the ecosystem has, the stronger his leadership and the centrality of his position (Sawhney and Nambisan, 2007). The co-evolvement

of the capabilities of the remaining actors is growing out of the determinants of the position of the central actor and the resulting BE structure (Zahra and Nambisan, 2012). Other authors support that view by stating that strategic decisions of the central player (being very open and distributing value to other ecosystem members) can determine the ability to innovate within that BE (Isckia, 2009). Still, the ability to govern is dependent on the environment or ecosystem architecture he is based in. Four ecosystem architectures that offer different abilities to innovate (Sawhney and Nambisan, 2007) due to possible industry constraints have been re-introduced by Zahra and Nambisan (2012). The authors describe their model by the development of a matrix. They distinguish between the orchestra model, the MOD Station, the Creative Bazar and the Jam Central. The four architecture types are categorized by leadership and innovation space and can be classified in the 4x4 matrix. These four ecosystem architectures are described as follows:

Orchestra Model:

The orchestra model is led by strong leadership and small innovation space with a central firm as a platform leader. Furthermore, it is shaped by a high number of formal ties using formal agreements in order to influence necessary innovation with governance mechanisms near to a hierarchy.

Creative Bazar:

The creative bazar is also led by strong leadership in a centralised network but the innovation space is large. A platform leader deals with informal governance mechanisms such as trust and distributes innovative ideas among others.

Jam Central:

In contrast to the creative bazar the jam central model consists of less influential leadership based in informal relations and a great innovation space requiring a lot of KS. Here, other roles have a greater influence on developments. Therefore, the platform of exchange is very important here.

MOD Station:

The MOD Station is characterised by only a small innovation space with little leadership. Rather than a central player, an adapter shapes innovation activities. A mixture of formal and informal relations means that no strong governance mechanisms are existent.

All four models show that the regulatory power of the central player changes by relations maintained, its position and its innovation goal as well as its abilities within a certain environment. Orchestrators have some degree of control but it is changing by the environment the company is in (Isckia, 2009). The aspects outlined result into the display of **Figure 2.6**.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.6: Different network architectures and business ecosystem roles

(Source: Sawhney and Nambisan, 2007, p.84)

The actors within the four different ecosystem models are challenged by differences in their roles and strategies, in their ability to govern the network, to ensure KS and to manage innovation (Sawhney and Nambisan, 2007). Therefore they face challenges within their organisational setups as well, referring to internal challenges such as organisation culture and adaptability as well as external challenges such as the management of network relationships (Sawhney and Nambisan, 2007).

Summarising the above, Sawhney and Nambisan (2007) take the perspective of the central firm with its own goals as well as the shaping perspective of the innovation network structure (Sawhney and

Nambisan, 2007). They refer to the industry as being a shaping element but focus on the innovation aim of the central company. They explain how the capabilities of the central actors change with its roles, being a Dominator and value extractor of the BE or a Keystone and a value creator (Zahra and Nambisan, 2012).

This corresponds to the players outlined in BE, who can influence their platform depending on the innovation aim, the role of the agent and the relations he maintains. Depending on the type of relations, being either direct or indirect relations, formal or informal relation, the position and influence changes (Iansiti and Levien, 2004a; Sawhney and Nambisan, 2007) as well as the ability to share certain types of knowledge.

These reflections can be referred back to considerations made in this work on CR in BE and networks. The model introduced above shows the interdependence between network governance mechanisms, formal and informal relationships, exploration or exploitation of knowledge and innovation space which can be adapted to BE architectures.

Subjects relating to the considerations above have been discussed in the network level section and refer to network structures and relations such as structural and relational embeddedness. Open and sparse networks (Burt, 1992), closed networks (Coleman, 1988) as well as the degree of firm centrality (Zheng, Zhang and Du, 2011; Gulati, Lavie and Madhavan 2011; Granovetter, 1992) and tie strength (Granovetter, 1985; Granovetter, 1992) correspond to the concept outlined above. Centrality and openness of the network in terms of embeddedness is a structural and relational perspective, which highly influences the mechanisms of network governance and KS (Jones, Hesterly and Borgatti, 1997; Ahuja, 2000; Rowley, Behrens and Krackhardt, 2000). As already outlined in the KM section, these structural differences in networks have an influence on how knowledge is shared and what companies can be found in the network. The less hierarchical a network is structured, the less bureaucracy it contains and the more social mechanisms are ruling the network (Jones, Hesterly and Borgatti, 1997). Companies acting in a very structured and controlled network might have strong governance mechanisms, they are adapted to relatively stable conditions being a more mechanistic

type of organisation used to control. The organisation used to a changing environment, less able to control its network partner, is a more organic type of organisation (Roffe, 1999).

The organisation's ability to share knowledge within a network is not only dependent on the network structure the company is in, but also on its positioning and its role. The ability to exploit or to explore specialised or more general knowledge is determined by network governance, which in turn is influenced by the network structure and the relationship the network contains.

Taking the company's perspective and the environmental perspective explained above into account, as well as the findings of network interdependencies, network positions and KS explained, the concepts of the above explained authors shall be further developed as follows.

Depending on their network position also being influenced by the relations maintained, platform leaders can either be positioned decentralised in a strong embedded network or centralised (Inkpen and Tsang, 2005, Sawhney and Nambisan, 2007). Distinct advantages result from the positioning of the platform leader (Gulati, Lavie and Madhavan, 2011). The network furthermore can be formed by more formal or informal relationships which in turn determines the ability to influence and access the agents in the network (Gulati, 1999; Rowley, Behrens and Krackhardt, 2000). These interdependencies refer not only to Burt's and Coleman's discussion about closed and sparse network (Coleman, 1988; Burt, 1992), it also refers to the degree of platform openness governed by a central actor (Rong and Shi 2015) and the ability to access knowledge (Arya and Lin, 2007; Galaskiewicz, 1979; Galaskiewicz, 1985; Ibarra, 1993; Powell et al., 1996).

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Figure 2.7: Business ecosystem structures from a network theory perspective

Figure 2.7 and **Figure 2.8** are building on the mechanisms described in this section and the literature review. They are also adapted from concepts introduced by Rong and Shi (2015), Shang (2014) and Nambisan and Sawhney (2007). The four fields of the matrix displayed in **Figure 2.7** show four ecosystem architectures. The fields outline how the central agent is shaped by its position, depending on the environment it acts in, the relationships maintained and the degree of embeddedness. Relational and structural embeddedness are differed as well as the degree of centralisation- Additionally, the knowledge space accessible differs by business ecosystem architecture.

Figure 2.7 shows that, depending on the BE structure, the central actor can influence its platform distinctly and can also chose its strategy depending on the influence possible. They can more easily act as a Dominator when they can have strong system influence. Consequently, as central players agents can either act as a Dominator or as a Keystone (Sawhney and Nambisan, 2007). The Keystone would choose the strategy to collaborate with its partners (Iyer, Lee and Venkatraman, 2006) aiming on value creating than extraction. The more formal the relations, the higher the network governance influence. Depending on the ecosystem architecture, the relations and the position which in turn influences the possibilities of govern the network (Roffe, 1999) change as well as the capabilities of the core firm. Depending on its interest the core firm can control network agents by formal relations or relate on informal and social governance mechanisms.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 2.8: Network governance depending on business ecosystem structure

(Source: Wulf and Butel, 2016)

Figure 2.8 and **2.9** are the conceptual model developed out of all considerations outlined above.

Figure 2.8 adds to **Figure 2.7** by directly referring to network governance and influence of the central player depending on the business system architecture, the position and the relations maintained.

In strongly embedded networks network governance mechanisms rely on social mechanisms rather than authority (Jones, Hesterly and Borgatti, 1997). The changing governance mechanisms affect in turn the ability of companies to access and share knowledge (Rowley, Behrens and Krackhardt, 2000).

Additionally, the knowledge space the company can access changes by the type of relationships maintained as a greater variety of ties and access to direct and indirect ties can increase the knowledge space (Hansen, 2002; Shafique, 2013) as displayed in **Figure 2.9**. Here, **Figure 2.7** and **2.8** are combined and restructured to focus on knowledge space and network governance mechanisms enabling the access of knowledge.

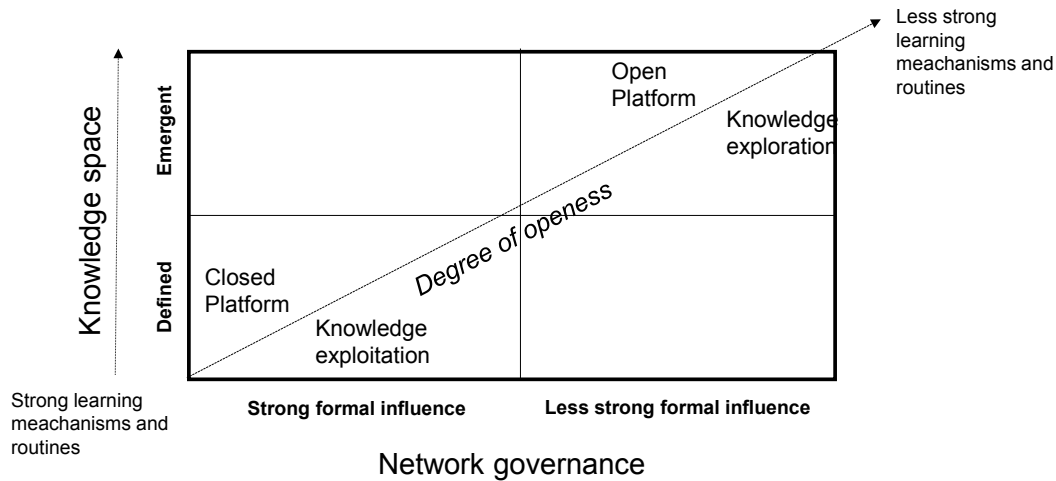


Figure 2.9: Platform openness, network governance and knowledge space

Seeing organisations embedded in network structures helps to explain resource and KS mechanisms, still it misses the heterogeneity aspect that characterises any organisation. As has been outlined before, every organisation is shaped by its characteristics, actions, capabilities, abilities, structure and its strategy and is therefore better or less able to access and share knowledge.

The figures above show that a central agent such as an orchestrator being a Keystone or Dominator in a central position in a formal network might have different knowledge accessing and sharing abilities than Keystones in less centralised and strong embedded networks. Furthermore, a central player in a network of formal relations might be able to acquire specialised knowledge whereas the Keystone in a sparse network is able to gain broad ideas.

Agents hold a certain position of structural and relational embeddedness, with a number of ties in a very dense or open network. All these differences point out that not every organisation profits the same way of being embedded in network structures and that the ability to share knowledge must depend of many individual factors. Therefore, not every role can be played by everyone. Agents are determined also by their position and relationships maintained within the network. Not every position enhances the same abilities to interact within the network (Zheng, Zhang and Du, 2011). The relationship between the roles is therefore as important as the role itself as it influences the development of the system (Isckia, 2009) and it enables the single firm to think about its own strategic

movements and how it could set ‘its own rules of the game’ (Zahra and Nambisan, 2012, p.220). Consequently, the role of the single agent and its influence in a network of CR, being centred on a shared vision or idea and being part of a BE, needs to be researched in more depth.

Summarising the above, the influence between environments, relationships maintained, knowledge sharing abilities, resulting governance mechanisms as well as the ability to fulfil a certain role or strategy are outlined in the conceptual model developed above. The model shows interdependencies as well as the necessity to consider different ecosystem architectures as well as distinct agent roles in BE research in order to understand how agents act in distinct network structures to reach innovation and competitive advantage.

2.6 Literature review summary

Altogether, this chapter outlines organisations in CR, considering organisational aspects as well as network and BE aspects to understand how knowledge is shared and competitive advantage can be gained by the single organisation. So far, CR have often been investigated from a holistic perspective focusing on network structures. BE theory offers a first perspective on certain agents in CR. The organisation and mechanisms for strategy making, KS and capability building in CR have been discussed in order to explain the need for an investigation of individual organisations in CR. Therefore, the role or strategy of these agents acting in different CR as well as their ability to manage and share knowledge are an important field for research.

After having outlined the literature narrative and an in-depth description of interrelations, the Keystone literature investigated is summarised below by its contributions. **Table 2.5** displays the contribution of 18 articles identified in the structured data collection process in **Appendix A**. **Table 2.5** shows that only a very small number of publications focus on a detailed Keystone agent description. The KBV is considered but not as often part of the research as the RBV in general. The agent strategy as well as an investigation on agent level need a greater focus. Summarising this, a structured Keystone description, its KS activities, investigated by applying a multilevel analysis can

be considered an appropriate research gap. Furthermore, a qualitative approach to investigate the relatively new area of research is suitable.

Review criteria	Content	Number of Publications (n=18)	Description of publications	Conclusion
Theoretical basis	Business ecosystem theory	17	BE theory as main theory of investigation.	BE and network theory as well as RBV and KBV are often considered as theoretical frames around Keystone investigation.
	Network theory	18	Any kind of network structures as part of BE. No detailed investigation of network structures.	
	Resource-based view	17	Improving resource base as main motive for interaction in networks and BE.	
	Knowledge-based view	10	Knowledge as important resource. No investigation on KS mechanisms.	
Focus of content	Collaboration	12	Collaboration between agents important in BEs. No detailed investigation who collaborates with whom.	Collaboration is a main motive in order to innovate. Only half of the publications consider the agent strategy in BE, even though they discuss the Keystone role. Most of the publications deliver a general description of agent roles. Only two publications describe the Keystone in more detail.
	Business ecosystem strategy	10	BE as a new implication for strategy formation.	
	Agent strategy	9	There is a BE strategy followed by agents in BEs. Agent strategy need to be aligned to BE strategy. No research on how strategy is formulated.	
	Detailed agent description	2	Detailed description of Iansiti and Levien (2004a; 2004b). They provide an unstructured approach.	
	General/brief agent description	16	Replication of Iansiti and Levien's (2004a) agent description.	
	Innovation	15	Innovation as prerequisite to collaborate or cooperate.	
Level of analysis	Business ecosystem level	16	Investigation on BE level.	Publications concentrate on BE and/ or network level. No publication conducts a multilevel approach considering a multilevel perspective.
	Network level	8	Network level often considered as BE level	
	Agent level	6	Agent as level of analysis, without simultaneously addressing network and BE level.	
Research method	Quantitative	1	Quantitative data analysis	Most of the publications are conceptual. Qualitative research is also common as it is useful in a relatively new field of research.
	Qualitative	8	Qualitative data analysis	
	Conceptual	9	Conceptual work by applying theoretical considerations. Including one literature review and two conceptual modelling publications.	

Table 2.5: Summarised contribution of main Keystone publications

3. Research gap and research questions

In the light of chapter two, it becomes obvious that the individual organisation in CR is important and BE theory already offers a first description of certain agent roles, but a structured approach to investigate these roles is still missing. Adding to that consideration, it is important to understand the role of certain types of agents within networks to understand them in a bigger system (Butel, 2014; Schatzki, 2011) and contribute to BE and network theory.

As agent roles such as the Keystone role, have not been researched in a structured way and the term role and strategy, as well as role and position, are named simultaneously in BE research, BE roles and their attributes need to be investigated in more depth. The Keystone role has been outlined as being a central role for BE survival (Iansiti and Levien, 2004a; Power et al., 1996; Stead and Stead, 2013; Clarysse et al., 2014), therefore it is essential to understand how they are able to fulfil their role to advance BE research. Consequently, the Keystone role will be researched in more detail in this work. Adding to this, Keystone KM and KS activities are also considered as well as the environment the Keystone acts in. Having outlined in the literature chapter that KS is one key element for influencing the development of CR as well as for the creation of innovation and competitive advantage, it is considered to be a key activity a Keystone follows to fulfil its role. Additionally, distinct structures of CR enable different mechanisms for influencing BE development and knowledge sharing. Consequently, the following research gap and research questions are outlined below.

Research gap: There has been to date no structured and comprehensive description of the Keystone role and its knowledge management and knowledge sharing activities (in order to reach innovation and competitive advantage) within more formal and more informal collaborative relationships. This research therefore addresses the following questions:

- **RQ1:** How can Keystone role similarities within more formal and more informal collaborative relationships be described?
- **RQ2:** How do Keystones manage and in particular share knowledge?
- **RQ3:** How do Keystones differ in more formal and more informal collaborative relationships?

The research questions can also be related back to the introduced theories and concepts of the literature review which is shown in **Figure 3.1**.

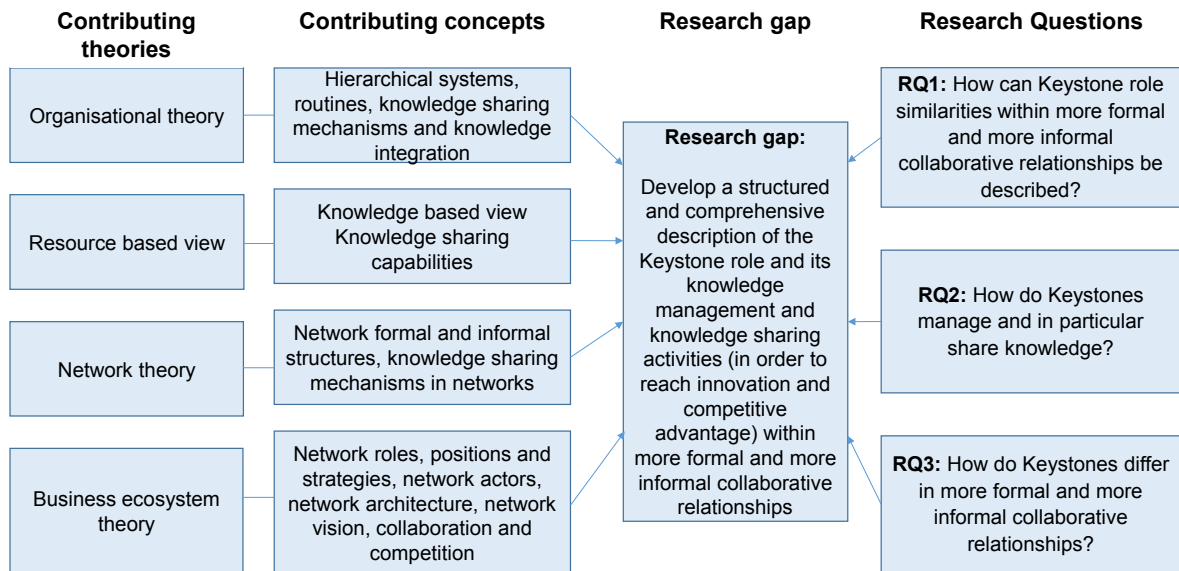


Figure 3.1: Research questions, research gap and contributing theories

In order to investigate the research questions stated above, and to consider the research objectives introduced in chapter one, the Keystone role, its KM and KS activities as well as the environment the agent acts in will be investigated. Specifics that define the Keystone will be explored under consideration of a particular relational context, developing a conceptual research framework that aims

to offer a holistic investigation of the Keystone role. This is supported by Zheng, Zhang and Du (2011) and Rong and Shi (2015) who developed holistic frameworks themselves for investigating BE dynamics. They state that context as well as processual aspects are important. Additional to that actor capability, governance aspects and BE construct specifics need to be considered (Rong and Shi, 2015; Zheng, Zhang and Du, 2011).

These considerations add to **Table 3.1** where all dimensions discussed in the literature review are sampled and displayed as well as related to the concept of De Wit and Meyer (2010). They as well suggest a holistic approach to strategy research. They offer the basis for a conceptual research framework for empirical research and data display in this work. De Wit and Meyer (2010) propose that research in SM should look at four different perspectives or dimensions being the structure, content, context and process perspective. While three dimensions are considered to be the main dimensions, structure is introduced by them as an additional important aspect to be considered and often not considered enough in SM research (De Wit and Meyer, 2010).

In this work, the literature review displayed that certain dimensions repeat themselves as shown in **Table 3.1**. These dimensions can be allocated to the structural and relational dimension, the context dimension and processual dimensions as well as the content dimensions relating to strategy or innovation content. Structural and relational dimensions refer to structural and relational elements on all levels of investigation. The processual dimension refers to knowledge sharing or strategy making aspects as they are underlying a certain process of activities. The content dimension is related to creative innovative content as a possible result of strategy making or knowledge sharing. The context need to be considered in a twofold way. First, it refers to the context of the study being for example the company, network or BE environment depending on the unit of analysis. As the unit of analysis is the individual and the company the study context perspective can differ but is referred to when necessary. Second, the research context is the context in which the study is undertaken. How study and research context relate to each other is displayed in **Figure 3.2**. Other than in De Wit and Meyer's

(2010) approach, the structural and relational dimension play an important role in this research as shown in **Table 3.1**.

Literature review			
Business ecosystem level	Structural dimension	Platform openness vs. closeness	Processual and content and context dimension (relevant for all levels) Context <ul style="list-style-type: none"> Structural, relational and cultural context Content <ul style="list-style-type: none"> Creating innovative content Reaching competitive advantage by creating strategic content Process <ul style="list-style-type: none"> Knowledge sharing (hindrances, prerequisites) Resource sharing Strategy making (open strategy approach)
	Relational dimension	Competition vs. collaboration	
Network level	Structural dimension	<ul style="list-style-type: none"> Open vs. closed network structure (accessible vs. not accessible network) Embedded vs. sparse (Structural holes) Structured (clear roles and tasks) vs unstructured dimension Close vs. loose network cohesion (directly relates to embeddedness) Regular interaction, management of the relations, joint goals and mutual dependency (Gulati and Singh, 1998). 	
	Relational dimension	<ul style="list-style-type: none"> Informal, formal (business relation VS contract relations) Degree of network governance (social vs hierarchical governance-link to structural dimension) social relation vs. economic relation (social tie/friendship or political tie) strong rules of participation vs. less strong rules (e.g. effective vs. less effective knowledge sharing routines) dyadic vs. multiple ties strong vs. weak ties (measured network theory) Bridging ties competitive vs. collaborative relationship 	
Company level	Structural dimension	<ul style="list-style-type: none"> Ability to react to industry changes static (structural inertia inertia) vs. flexible perception of firms Open vs. closed company boundaries (open strategy) mechanistic and the organic organisation (relates to structural dimension) 	
	Relational dimension	<ul style="list-style-type: none"> internal 'patterns of behaviour' (influence) or formally 'prescribed positions' (hierarchy) bureaucratic processes vs. informal processes competitive vs. collaborative relationship certain roles with certain tasks determined as well by relation 	
Individual level (personal level)	Structural dimension	<ul style="list-style-type: none"> hierarchical vs. organic company structure determine how individual person can access knowledge within the company and how the individual might connect itself with others in network individual connecting in embedded or sparse network structure 	
	Relational dimension	<ul style="list-style-type: none"> formal relationships vs informal relationships 	

Table 3.1: Repeating dimensions identified during the literature review

Consequently, the concept of De Wit and Meyer (2010) is applied to this research by enabling a holistic exploration of the Keystone role and its environment. The dimensions are used as underlying elements for a conceptual research framework and to answer the research question. As stated above the research gap is to develop a structured (structure) and comprehensive description of the Keystone

role and its KM and KS activities (process) (in order to reach innovation and competitive advantage (content)) within more formal and more informal (structure) collaborative relationships (context).

Addressing the four different dimensions additionally enables the researcher to define the research context. As already explained above, the context in which the organisations and individuals behave affects the role therefore it is essential to define the research context thoroughly as possible. Below in **Figure 3.2** the main repeating dimensions are linked to the four dimensions of De Wit and Meyer (2010) as well as to the research questions. The blue square marks the study context, whereas the red square encompasses the level of analysis. The colours in boxes relate to the four research dimensions. **Figure 3.2** also shows the context of the study being the network and the BE level while the unit of analysis is the individual and the company level.

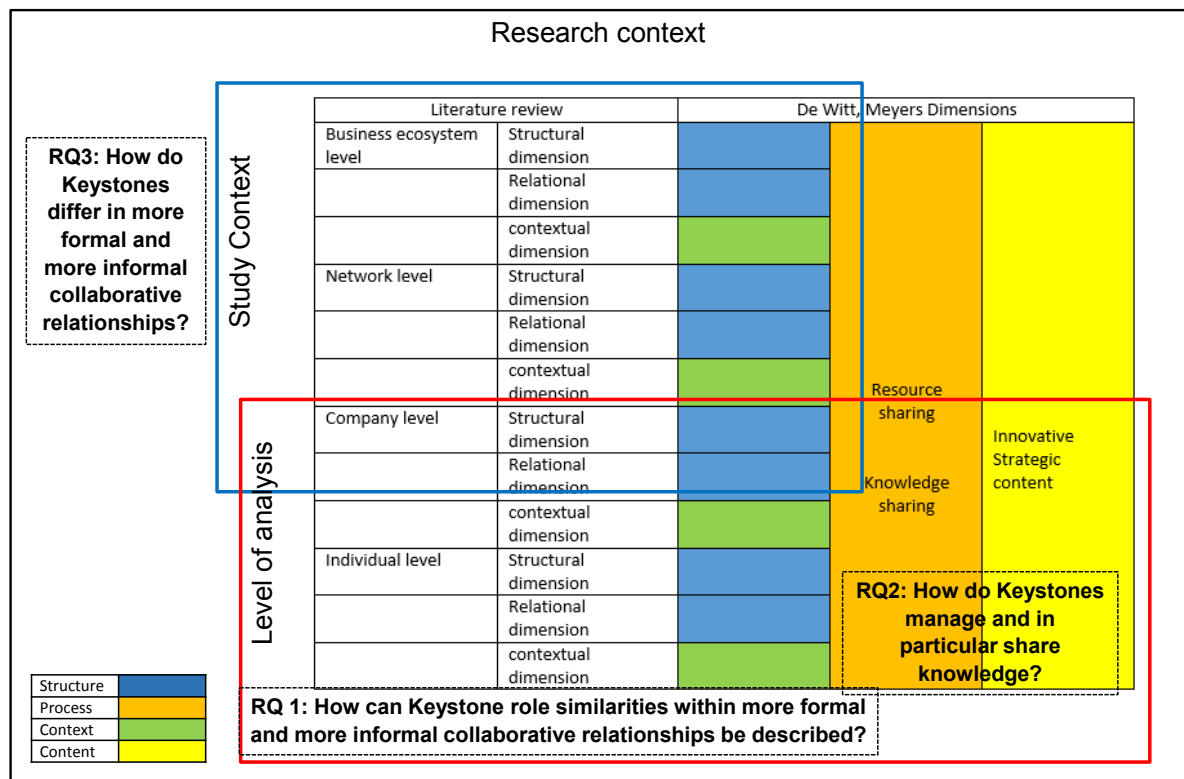


Figure 3.2: Literature review related to research question and to dimensions of research

As the Keystone agent is shaped by the individual and the organisation at the same time (Moore, 1996), and knowledge resides in the individual as well as in the organisation, **RQ1** and **RQ2** refer mainly to the individual and organisational level of analysis while **RQ3** considers the study context

as well. Building on the strategy as practise approach (Jarzabkowski and Spee, 2009) characteristics and actions on personal and company level are investigated in order to understand the role of the individual and the company for the Keystone, its knowledge sharing and for strategy making. Taking the strategy as practise perspective into account, the connection between the individual and the company as well as the mutual influence are aimed to be understood in more detail.

Taking all these considerations into account, the following conceptual research framework for investigating the Keystone role can be identified by including De Witt and Meyer's (2010) dimensions (**Figure 3.3**). This enables a structured description of the Keystone role in its environment. The Keystone level investigation will be specified and linked to a concept in the data analysis section, providing a structured basis for raw data analysis as shown in **Figure 7.1** in chapter seven.

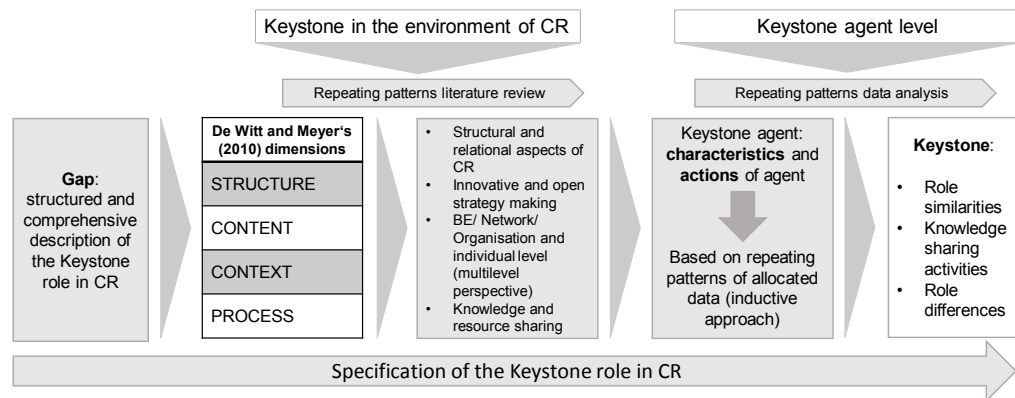


Figure 3.3: Conceptual research framework for investigating the Keystone role

The content, context, process and structure dimension of De Wit and Meyer (2010) are also related to method selection in the methodology section to ensure that all methods used are also selected by their ability to contribute to research questions as well as to the different dimensions as outlined in the next chapter.

4. Methodology

This thesis aims to answer the question how the Keystone role within more formal and more informal CR can better be understood. Building on the considerations in chapter three, it is important to understand the Keystone role in its context. As network strategies of the agents are not only dependent on the company and its strategy, but also on the person active for the company in the network, a multilevel analysis is necessary. This requires a complex methodology and methodological framework which enables the researcher to deeply analyse the networks investigated.

The methodology chapter starts with explaining research philosophy and methods. The chapter then continues with selecting a suitable research philosophy that fits to the researcher's view of the world and methods that are fulfilling the research objective. This chapter outlines research strategy, design and methods as well as research ethics.

4.1 Research philosophy

Research philosophy describes the worldview underlying the research and the theoretical foundation of the scientific work (Saunders, Lewis and Thornhill, 2012). The research philosophy not only determines the approach of the research undertaken, but also the importance of methods fitting to the approach, enabling the researcher to collect suitable data (Saunders and Lewis, 2012). First of all, it is important to understand how the researcher sees the world to be studied by considering two different philosophical approaches. Ontology explains how the researcher understands the nature of reality and epistemology explains the way this nature can be accessed by the researcher. Easterby-Smith, Thorpe and Jackson (2015) distinguish in that context between the researcher as a bystander or a participant of reality.

Ontology in social science is mainly shaped by two opposed views. First, the realist perspective seeing the world as one single truth, a one and only reality that exists. Second, the relativist perspective, which explains that there are many approaches to reality that are all dependent on the individual perspective (Easterby-Smith, Thorpe and Jackson, 2015). Holden and Lynch call these views

objectivism and subjectivism (Holden and Lynch, 2004). Objectivists see the reality as being external to the social actor and the researcher is independent from his observations (Adcroft and Willis, 2008; Saunders, Lewis and Thornhill, 2012). Subjectivists are often called humanists and interpretivists and are seen as qualitative or phenomenological approaches (Holden and Lynch, 2004). The phenomenological paradigm relates to the essence of lived experience and the consciousness of the human being (Fouche, 1993) which is accessed by qualitative methods.

Epistemology means how the researcher approaches the world during the research. Beside the two opposed views of positivism and social constructivism, mixtures of both views exist. The positivist approach emphasises that the social world exist externally and that its characteristics can be measured by certain quantitative methods. Constructivists assume that the reality observed is shaped by certain actors in certain surroundings and is therefore a social construction (Mir and Watson, 2001) that needs to be observed by certain qualitative methods. **Figure 4.1** shows the different epistemologies and where this work can be allocated to, which are marked by a red frame.

The constructivist position means that there may be many realities depending on the research object investigated, therefore the researcher needs to gather multiple perspectives by a mixture of methods and collect the views of the different individuals. This means the researcher needs to make sure that not only data is collected by data triangulation but also by method triangulation (Easterby-Smith, Thorpe and Jackson, 2015). Researchers often argue that social constructivism does not enable generalisation as the data generated is always related to a certain context. This problem is addressed by researchers in qualitative research by using triangulation as one possible way that enables the researcher to consider many different perspectives. In sum, these perspectives draw a picture of the context that can be generalised to other situations of the same kind (Mayring, 2007). In this research, the relativist and social constructivist perspective are taken as research philosophy. The research question and the research approach address a very complex surrounding that needs to be handled by methods that can display complex research contexts. Furthermore, the researcher believes that

multiple perspectives need to be taken in order to understand the world in its complexity and to generate findings that are generalisable to a certain extent.

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Figure 4.1: Methodological implications of different epistemologies

(Source: Easterby-Smith, Thorpe and Jackson, 2015)

4.2 Triangulation

Triangulation refers either to the collection of data by addressing distinct data sources or by using different collection methods that can create a triangle around the phenomenon and support the findings. Consequently, method triangulation often results in a multi-method approach (Campbell and Fiske, 1959; Easterby-Smith, Thorpe and Jackson, 2015). Data triangulation means that certain individuals are accessed by multiple viewpoints and by different methods such as interviews, observations or documentation (Easterby-Smith, Thorpe and Jackson, 2015). Especially in a case study method it is important to substantiate information from a variety of sources, by taking different angles of perspectives (Ghauri and Grønhaug, 2002). In this research, multiple data collection methods are taken and data triangulation is used to substantiate the findings.

4.3 Research approach and design

A research design is a framework that guides how research should be conducted, based on people's philosophies and their assumptions about the world and the nature of knowledge (Collis and Hussey, 2014). It is important to understand "the details of the situation to understand the reality or perhaps a

reality working behind them” (Remenyi, 1998, p.35). The research in this thesis is related to social constructivism. Insights into a research phenomenon are believed to be complex and the reality behind these complexity is lost when it is generalised and reduced completely (Saunders, Lewis and Thornhill, 2012). Social constructivists often follow an inductive approach in order to build theory. Inductive means that no theoretical assumptions exists beforehand and that the researcher addresses the phenomenon without pre-assumptions. Deduction includes the development of a certain theory that is then tested (Easterby-Smith, Thorpe and Jackson, 2015). Most researchers separate both approaches and link them to one philosophical perspective being either part of a social constructivist or of the positivist perspective. Still, inductive research needs to be aware of theory. Often social constructivists work with grounded theory that implies that no theory at all is existent before the researches starts with the actual field work to address the phenomenon (Glaser and Strauss, 2010). The grounded theory approach is not considered to be suitable for the approach followed in this thesis as a certain theory, the BE theory, is already chosen in the literature to be the main theory of interest. But as this theory is still not investigated in-depth, as shown in the literature review chapter, and not linked adequately to other theories that explain similar phenomena, overlapping ideas and concepts of existent theories need to be explained first. In the literature review chapter this has been done by a conceptual literature review (Wulf and Butel, 2016). The literature review outcome created a new way of conceptualising CR in BE and networks and created a first understanding of the Keystone role, its specifics and its ability to share knowledge. Conceptual research uses data, gained mainly from existing knowledge and concepts by detecting new contexts and relations (Xin, Tribe and Chambers, 2013; Wulf and Butel, 2017). As a consequence, the structured literature review provided a conceptual model on interrelations as displayed in Figure 2.8-2.9. This conceptual model draws a first picture of how BE and network theory relate to each other, defining a research context in which the role of the Keystone agent can be investigated. Still, this model is not used to support the testing of hypothesis, but rather provides a frame that helps to develop the relevant research questions, which require a qualitative and inductive approach to data collection (Saunders, Lewis and Thornhill, 2012).

In practise this means that a certain deduction from theory was necessary to develop a frame for research in which data collection could then occur inductively.

Research conducted inductively is often applied to complex contexts and settings requiring only a small sample of subjects (Saunders, Lewis and Thornhill, 2012) often supported by a variety of methods and data and method triangulation (Easterby-Smith, Lyles and Tang, 2008; Easterby-Smith, Thorpe and Jackson, 2015).

As explained by Easterby-Smith, Thorpe and Jackson (2015), and illustrated in **Figure 4.1**, a case study design is suitable to address the philosophical assumptions underlying social constructivism. It also suits the need of collecting data to display the complex setting the researcher faces during his field work (Easterby-Smith, Thorpe and Jackson, 2015). This also is appropriate because the research objectives and questions asked in this thesis are of exploratory nature. Exploratory research can help to understand a certain problem in-depth and is supposed to be conducted during the initial stage of research in an area. Another argument for the case study being appropriate as research design is that the purpose of exploratory research is to gather a vast amount of data to understand a problem in its complexity (Yin, 1994).

Research design and research strategy are often employed interchangeably in literature (Yin, 1994; Easterby-Smith, Thorpe and Jackson, 2015; Saunders, Lewis and Thornhill, 2012; Bryman and Bell, 2015). Here, the research design is used to explain the methodological frame for the methods used and the term research strategy will be used later to explain how the methods were combined to answer the research questions. “A research design is a framework that guides how research should be conducted, based on people’s philosophies and their assumptions about the world and the nature of knowledge” (Collis and Hussey, 2009, p.55).

4.3.1 Case study analysis

Summarising the above, a case study approach allows the researcher to deeply investigate the role of the Keystone agent and its KS activities. Methods for data collection are no neutral tools. They are

aligned to how the researcher imagines the world and how he or she believes the world is build up (Bryman and Bell, 2015). The aim is to increase the broad understanding of a situation and to gather rich data from ideas introduced, adopting a social constructive approach (Easterby-Smith, Thorpe and Jackson, 2015). The social constructive approach is also suitable for analysing unique and complex situations (Saunders, Lewis and Thornhill, 2012). Case studies are used in complex settings and situations as well (Xiao and Smith, 2006) and allow an understanding of the dynamics present in certain settings (Eisenhardt, 1989a). Additionally, case studies do not require control over events and focus on temporary settings (Yin, 2014). Furthermore, case studies can support to generate (Yin, 2014; Ketokivi and Choi, 2014) and sample theories (Glaser and Strauss, 1998). “Theory development can occur through the systematic piecing together of detailed evidence to generate (or perhaps replicate) theories of broader interest” (Hartley, 1994, p.324). A case study can investigate a phenomenon in-depth and within its reality, but it is also very limited by its uniqueness (Dyer and Wilkens, 1991).

The uniqueness of case studies can be its weakness, too. The latter is met by a multiple case study design (Yin, 2014), which also enables the analysis of more than one particular network agent. Multiple case studies can as well help to generalise replicating findings (Herriott and Firestone, 1983). Still, they do not offer a complete representation of the reality or the existent population (Eisenhardt and Graebner, 2007). In this research, a multiple case study investigating two case studies is used in order to ensure access to particular network agents in different relational positions and BE architectures. The difference in cases is necessary to find similarities and differences between the agents investigated. Therefore, the research context needs to be clearly defined, as already explained at the beginning of this chapter.

Case studies normally use data collection methods such as archives, interviews, questionnaires and observations (Eisenhardt, 1989a). For theory building multiple data collection is used but not all methods need to be used all the time. Research focuses on the method that enables the best data collection possible and ensures that it provides enough evidence for example by triangulation

(Eisenhardt, 1989a). In this research, data triangulation is used by addressing investigated individuals and their perceptions supported by method triangulation (Beverland and Lindgreen, 2010). Theory building is characterised by replication logic (Eisenhardt, 1989a), which means that repeating results gathered by different methods will help to build theory from the findings.

The multiple case study design used in this study supports to increase the ability to build theory from repetition logic. Each case is considered its own experiment and analytical unit. Findings that support each other by cross analysis enable a higher generalisability (Eisenhardt and Graebner, 2007). “The theory is emergent in the sense that it is situated in and developed by recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments” (Eisenhardt and Graebner, 2007, p.565).

A multiple case study method aims at replication, theory extension, contrary replication or the exclusion of alternative solutions (Yin, 2014). Theoretical sampling can be supported well by using polar or opposing types of cases where the researcher looks at two extremes. Here, results lead to clear patterns of relationships (Eisenhardt and Graebner, 2007).

4.3.2 Cross sectional research and cross-case analysis

Research can be conducted, either cross-sectional as a snapshot of the case at a certain time, or as a longitudinal study that focuses on the outcome shown due to a certain length of the study (Saunders, Lewis and Thornhill, 2012). In literature it is not defined from what length of the study onwards a longitudinal study starts or ends and a cross-sectional study begins. Most research is conducted as a snapshot due to time and money constraint (Bryman and Bell, 2015). Due to time constraint this research conducts a cross-sectional study. In order to improve the generalisability of data, a cross-case analysis building on the multiple case study analysis can enable the researcher to improve pattern matching and theory building (Eisenhardt and Graebner, 2007). In this research a cross-case analysis is undertaken on the basis of the analysis of each case.

4.3.3 Reliability and validity of case studies

Even though qualitative research focuses on authenticity, reliability and validity are very important to ensure the generalisability of the case (Patton and Appelbaum, 2003). “The most serious and central difficulty in the use of qualitative data is that the method of data analysis is not well formulated” (Miles, 1979, p.591). In order to meet that problem, Marshall and Rossman (2014) suggest to ensure the following aspects when qualitative research is conducted:

- the process of knowledge generation during research is well defined
- the research problem is clearly stated and the research questions asked fit to the research problem
- outcomes of the data are reported clearly and explicit
- the conclusions can be reported back directly to the findings

As Yin (2014) stated that qualitative research needs to be documented clearly so that any individual researcher can conduct the same study under the same circumstances again.

This directly refers to research reliability. Reliability is considered to be the likelihood of producing similar results when repeating a researcher’s study (Bush, 2012). Memos and comments on the research process need to be taken and archived so that the research is understandable for external researchers (Saunders, Lewis and Thornhill, 2012). In order to ensure validity and reliability, the research process is defined in detail in the research construct section. Below in **Figure 4.2** the approach of Saunders, Lewis and Thornhill (2012) is linked to this research in order to provide an overview on data collection and analysis.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 4.2: The research ‘onion’ adapted to this research

(Source: Saunders, Lewis and Thornhill, 2012)

4.3.4 Research ethics

To consider research ethics is fundamental to ensure the appropriateness of research. This means that the rights of study participants need to be taken into account (Saunders, Lewis and Thornhill, 2012). Especially how the data is accessed and processed is a sensible area for research ethics. It is the responsibility of the researcher that participants are well informed, their privacy rights are reflected and that they have an understanding of the purpose of the research (Buchanan and Bryman, 2011). All participants in this research were informed about their privacy rights, about the purpose of the study and about their right to leave the study at any time wished. Information given to the participants can be found in **Appendix B** and **C**. Questionnaires were distributed in advance of the interview and were accompanied by an explanatory sheet. All answers and information were promised to be kept confidentially. This also ensures honesty of answers.

All ethical considerations were listed before the study took place and were approved by the ethical committee of the university. This confirms that the study fulfilled the ethical principles of the University of Plymouth.

4.4 Data collection methods

In order to enable a qualitative data collection approach that meets the requirements of a comprehensive exploratory research, suitable data collection methods need to be chosen. In the following important qualitative data collection methods are outlined.

4.4.1 Interviews and expert interviews

Qualitative research is rather concentrating on words than on numbers (Bryman and Bell, 2015). It concentrates on the investigation of the world as it is and as it is perceived by its participants (Bryman and Bell, 2015). Interviews are a renowned method in qualitative research to collect valid and reliable data (Saunders, Lewis and Thornhill, 2012). The reliability of data from interviews can be improved when experts of great expertise of a specific context are interviewed that can enable an insight to the phenomenon from different angles (Eisenhardt and Graebner, 2007). Expert interviews are often used to complement other methods, therefore it is very important to find the right experts, by considering what part of the person's life is relevant (Flick, 2014).

Interviews can be conducted in a very structured way, semi-structured or open in-depth interviews (Gudkova, 2018). Especially in exploratory contexts structured interviews are not very suitable as they are aiming at a certain outcome already (Saunders, Lewis and Thornhill, 2012; Bryman and Bell, 2015).

4.4.2 Observation

Observation is an appropriate method to discover people's actions and the meanings to them (Saunders, Lewis and Thornhill, 2012). Researchers can either actively participate or not participate at the observed settings. Non-Participant observation enables the researcher to observe without interruption and generate findings on behaviour and communication structures for example (Yin, 2014; Sarantakos, 2012). The aim of the field researcher is to become part of the setting and being able to describe phenomena as detailed as possible (Bailey et al., 1996).

4.5 Research construct

In this work, the research construct is the initial step to theoretically ground the research and develop a suitable research strategy. Hence, appropriate research methods are developed in order to meet the research approach and theoretical requirements. It is important to include interpretative work in front of the theoretical background and within an empirical context (Miller and Tsang, 2011). Therefore aspects of theory that has been discussed in the literature review will be taken into account as well as methodological requirements. First, the research question is reintroduced and the importance of a multilevel analysis is explained to support the method selection strategy. Second, the requirements of a multilevel analysis and how these requirements are met by considering the dimensions of strategy research De Wit and Meyer (2010) are outlined. This is also done by structuring the research into different research stages (Meredith et al., 1989). After that, the methods used are explained to show how data collection aims are met throughout the research. The final part of this chapter explains the method chosen in more detail and what requirements are formulated for selecting the most suitable cases and participants to ensure validity, reliability and generalisability (Eisenhardt and Graebner, 2007). All these steps are outlined in detail in order to avoid the main bias in qualitative research, which is that the method of data analysis is not well formulated (Miles, 1979).

4.5.1 Research problem and research question

As already stated above, the research gap was identified as being the description of the Keystone role and its KS activities in more formal and more informal network structures. The research questions ask for a structured role of the Keystone agent, its KM and KS activities and the distinction of agents in different CR. Answers related to the research questions aim to generate an understanding about the company and the individual person fulfilling the Keystone agent role. In addition to that, environmental characteristics, explained as being the study context, are important in order to explain the role sufficiently. Even though the environment cannot be explained completely, as for example a BE is nearly impossible to be precisely delineated (Butel, 2014), certain aspects of the environment

need to be considered. As already introduced in chapter three, the holistic approach to strategy research introduced by De Wit and Meyer (2010) will help to meet the complexity of the research approach.

Whereas the focus of the research question is laid on structural and processual aspects, the context and content dimension play a vital role as well. The fulfilment of a Keystone role is dependent on the individual and the company engagement (Iansiti and Levien, 2004a; Moore, 1996) being active on company, network and BE level. Therefore a multilevel analysis is required in order to understand the characteristics that shape the Keystone role on all levels of the analysis. Additional to that, actions that can be allocated to understand the Keystone role and KM and KS activities are important as well.

Figure 4.3 shows how aspects of the research gap and the research questions, focusing on the Keystone role, its KS and its environment, can be allocated to the dimensions of De Wit and Meyer (2010) building a conceptual framework for investigation.

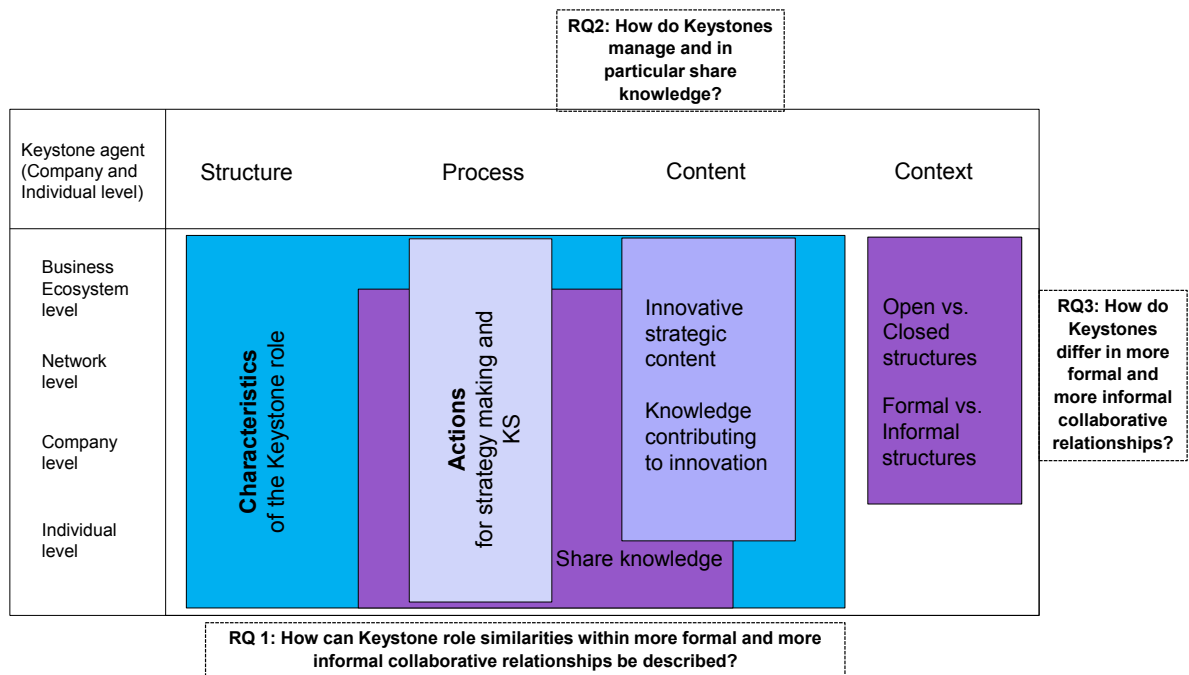


Figure 4.3: Research questions linked to multilevel perspective and to research dimensions

4.5.2 Multilevel analysis

As already explained above, in order to gain an understanding about particular agents in networks and the individual and company level, a multilevel analysis is required. Researcher support this by emphasising that a multilevel analysis is key to understanding BE and Keystone dynamics (Power et al., 1996), which is also applying for research in network theory (Möller, Rajala and Svahn, 2005). Research on KM and KS requires the same multilevel approach as knowledge is shared on all levels of interaction (Zander and Kogut, 1995). Even though the industry level and network level is considered to be a highly influencing factor, the focus of this research and the unit of analysis of this study is the individual company. Strategic market aspects and influencing factors are considered and investigated but the focus is on processes and mechanisms (Berghman et al., 2013) that describe the Keystone role and enable it to share knowledge in CR. Therefore, an organisation level of research, rather than an industry level of research is taken (Gulati, Nohria and Zaheer, 2000).

In-depth analysis of the company and the individual acting as agents in networks is aimed at in order to find out about their characteristics, actions and the context they are in. Especially as knowledge originates at the level of the individual, and KS takes place at the individual and the company level (Nonaka, 1994; Marabelli and Newell, 2012). The unit of analysis is therefore the individual as a starting point and the company as being the frame giving institution behind the individual. The company is considered to influence the actions of the individual person in order to gain strategically relevant knowledge. The unit of analysis is important to be defined as the data collected is determined by it (Yin, 2014).

4.5.3 Research stages

In order to meet multilevel research requirements that are influenced by the multilevel analysis, as well as the different dimensions of the research questions, a case study analysis investigating multiple cases were chosen. Case studies are suitable to display complex settings and multiple cases ensure a certain generalisability (Eisenhardt and Graebner, 2007; Yin, 2014).

To choose suitable methods, certain study specifics need to be considered. As stated above, the individual agent is the unit of analysis. From here, certain generalisations will be addressed to the network and ecosystem perspective (Butel, 2014; Schatzki, 2011). Still, the network level perspective and the BE perspective will also be investigated to a certain extent being the study context (see **Figure 3.2**). Understanding the study context is necessary in order to explain the context the network agent operates in. Additionally, case study access and Keystone agent identification require a good knowledge about the environment the Keystone acts in.

These considerations require a certain mixture of methods that allow to investigate the Keystone agent under comparable circumstances which required a first overview of possible research settings. Therefore, the research was conducted in two stages. The first stage was an orientation stage that enabled the researcher to understand the context of the agents in networks. This first stage helped to delineate the BE and the network structures the agents act in. Furthermore, it led to an understanding of how the case studies could be chosen and conducted and which case study requirements needed to be fulfilled. In order to ensure that a good overview, expert interviews were conducted at this stage as the reliability of interview findings can be ensured by experts of a certain context (Eisenhardt and Graebner, 2007). Expert interviews are very suitable to complement other methods as they help to understand the relevance of certain subjects (Flick, 2014).

The second stage was the case study itself. Critical for the case study was the mixture of methods chosen. They had to ensure the possibility of triangulation (Campbell and Fiske, 1959; Easterby-Smith, Thorpe and Jackson, 2015), they needed to meet the complexity of the research approach and they had to consider a structured approach to the research question introduced above in **Figure 4.3**. Additional to the methods chosen for the case study analysis, the selection of cases was also crucial to ensure validity, reliability and generalisability (Patton and Appelbaum, 2003). The overview created in research stage 1 also helped to further develop selection criteria for the cases. In the following, **Figure 4.4** shows how the different research stages influenced each other.

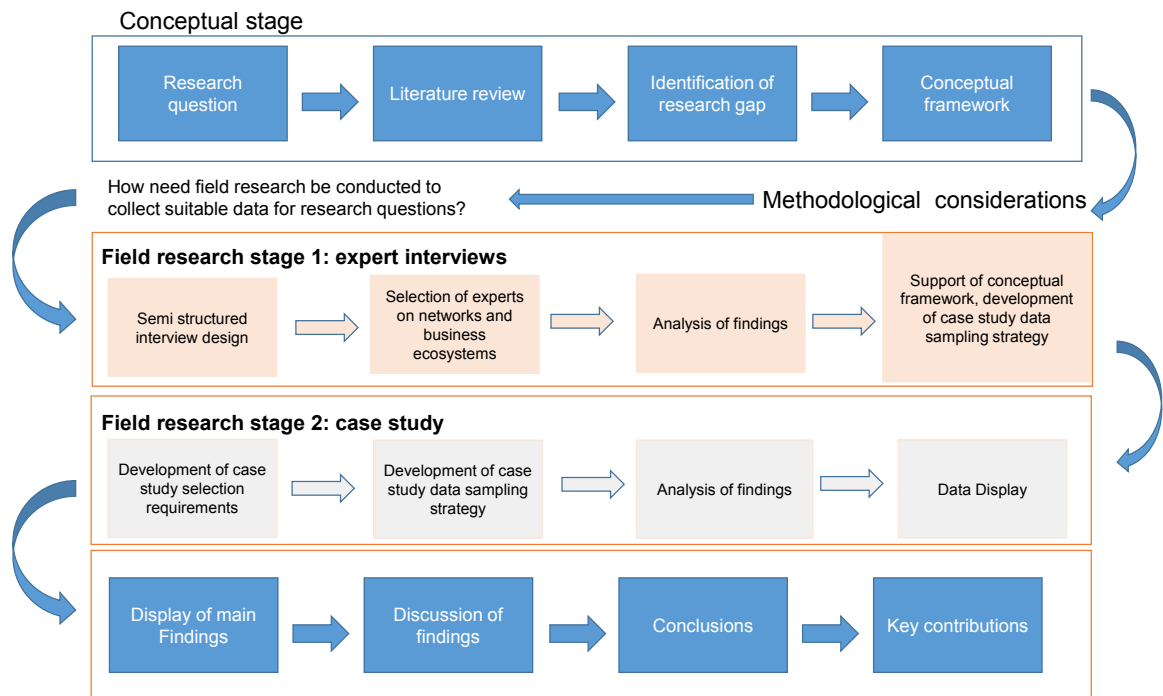


Figure 4.4: Research stages, their outputs and their influence on each other

4.6 Method selection for field research

This section highlights the methods selected for field research to meet the requirements of the distinct research stages. The details of data collection and processing are provided in chapter five.

4.6.1 Research stage one

4.6.1.1 Expert Interviews

As already explained above, expert interviews offered an opportunity to get an overview of the area the research was conducted in (Eisenhardt and Graebner, 2007). Additionally, they supported to develop supplementing methods for case study research (Flick, 2014). Research stage 1 was also used to further understand and enrich the findings of the literature review and development of the conceptual model (Wulf and Butel, 2016).

The findings of the expert interviews were planned to give a better understanding on networks and BEs and their dynamics. They were to address the understanding and definition of networks and BEs

as well as network and BE similarities and differences. In addition, the understanding of agent roles in CR was aimed to be advanced.

Findings of the expert interviews were also planned to help to strengthen the case study approach (Berg and Lune, 2017). Therefore the experts were asked about role behaviour in different network or BE structures and about certain characteristics that can help to identify the agents. In order to ensure data saturation at some point, the number of experts needed to be high enough (Glaser and Strauss, 2010). At least ten experts were planned and straight selection criteria for the experts were developed to ensure comparability and generalisability of the data (Saunders, Lewis and Thornhill, 2012). These selection criteria are displayed in **Table 4.1**. The selection criteria referring to network structure and industry were supposed to show a great variety, meaning that experts from different network structures with different network access, as well as from different industries, were addressed. This ensured a broad overview on expert's perceptions on BE and network structures and their roles or strategies taken within that structures as well as how KS takes place.

Expert position	Working experience/ network experience (years)	Network relations/ accessibility of the network/ structure of the network	Industry
Platform or network manager (organically or governmentally developed network structures)	At least 2 years of working experience with network structures	Experts working in closed and open network structures (variety of contexts experts are in is required)	Experts from a variety of industries (variety of industries experts are in is required)

Table 4.1: Selection criteria of expert interview participants

4.6.2 Research stage two

4.6.2.1 Case study research

As already described above, qualitative research is used to investigate concepts that are not well understood or researched in order to do rich exploratory research (Stebbins, 2001). Several different methods within the case were used to triangulate data but also to cover the complexity of the research

and the research question. Rich data also supports to validate and generalise findings when data reaches the saturation point by repetition (Glaser and Straus, 2010; Eisenhardt and Graebner, 2007). As explained in the multi-level analysis section, the selection of methods also needed to ensure that data, with a focus on characteristics and actions of the agents, was collected for all levels of analysis to sufficiently describe the context the agents act in.

As the unit of analysis is the company and the individuals acting as particular agents, it was important to reach a context variety in order to find similarities in characteristics and actions that can be related to the research questions and that repeat themselves even when the context changes. That is why the context of research needed to display a variety of criteria when it came down to the case selection. Different cases displayed different contexts and therefore were expected to validate repeating findings (Eisenhardt and Graebner, 2007). This means that a multiple case study of two opposing cases was the most appropriate way to validate repeating data. Furthermore, aspects that were discovered in the expert interviews about BE structures and network structures, as well as actions and characteristics related to the agents, also needed to be taken into consideration.

Another aspect was important to ensure the correct selection of the company, being an agent in network structures. Triangulation became very important here, as the individual company or agent could not be accessed solely by the studying of certain company criteria or secondary data in this research context, it was important to find the right point of entry for the case (Yin, 2014). That meant that the selection of methods also needed to consider the necessity of data triangulation in order to validate the identification of agents in networks.

Furthermore, it was important to define what the case actually is (Yin, 2014). Even though the unit of analysis was the single company, the case was chosen to be on a network level for three main reasons:

- First, a BE cannot be precisely delineated (Butel, 2014) and is therefore not selectable as a case.

- Second, as KS takes places between the organisations and individuals on an inter-organisational level, the case was defined to be on a network level (Inkpen and Tsang, 2005).
- Third, selective actions of particular agents by definition can only be observed on a network level (Schatzki, 2011).

This considerations made it necessary to approach the network level and identify the structure of the cases investigated. Which meant that a method needed to be developed that ensured the researcher's access to the network level, investigate the network structures as the company and individuals' context and then identify the Keystone agent as person and company. Consequently, a network mapping method was developed to access and understand the specifics of the network, in addition to the traditional case study methods, such as interviews, observations and document analysis. All methods are discussed below in more detail.

4.6.2.2 Case Study selection

One central aspect of data collection is that appropriate cases for analysis are chosen (Yin, 2014). No ideal number of cases is given. It is the information richness of cases that should guide their selection (Patton, 1990; Eisenhardt, 1989a). The cases selected were applied as being instrumental and confirmatory. Instrumental means the understanding of new aspects in the cases themselves and confirmatory the confirmation of theoretical aspects mentioned in the literature review for theory development (Healy and Perry, 2000; Perry, 1998; Miles and Huberman, 1994).

As already stated above, a multiple case study analysis was chosen in order to ensure a certain replication of findings to increase the reliability and robustness of the findings (Yin, 2014).

This is why the cases were chosen to have opposite contextual characteristics. As there is no ideal number of cases and the replication and data saturation shows the researcher if generalisability is possible (Herriott and Firestone 1983; Eisenhardt, 1989a; Strauss and Corbin, 1990; Yin, 2014), the case study selection remained to be two cases only. Additionally, data saturation was reached by this selection, as realised during the research process.

Another possibility to reduce bias and increase generalisability of findings is to include the retrospective into real time cases (Leonard-Barton, 1990). This is done by considering the length of case study investigation and by the inclusion of retrospective questions in interview questions. Both can be supported by documentation and archival data (Eisenhardt and Graebner, 2007). The critical incidents technique (CIT) can help to find repeating data around certain incidents of development when critical incidents are specifically asked for (Hughes, 2007). This could also be incidents in the past that help to understand actions of certain agents. Especially when distinct sources repeat certain key events that happened in the past, this can be considered to be critical incidents of development (Chell, 1994).

Summarising the above, it was important to consider that cases needed to be chosen by their possible contribution to theory: “but although multiple cases are likely to result in better theory, theoretical sampling is more complicated. The choice is based less on the uniqueness of a given case, and more on the contribution to theory development within the set of cases” (Eisenhardt and Graebner, 2007, p.565).

The cases to be investigated were selected by criteria that were summarised from the findings of the literature review about KS in collaborative relations, BEs and agents in BEs. Interview findings helped to develop case selection criteria further. The developed selection criteria are displayed in **Figure 4.5 and 4.6**. Agents in networks were suspected to develop the same or different KS actions or characteristics depending on the environment of their network structures or BE structures. Therefore two opposite cases were selected in which the agents act in differing contexts with environmental differences.

Variety factors	Case I	Case II
Roles investigated	Keystone	Keystone
Industry environment/ Business ecosystem stability (development stage)	Unstable	Stable
Network architecture	Centralised	Centralised
Central firm influence	Strong	Strong
Network governance mechanisms	More formal than informal mechanisms	More informal than formal mechanisms
Knowledge sharing platform	Closed	Open

Figure 4.5: Selection criteria for main case studies

Additional to the main selection criteria 70 publications on BE were analysed by the industry they addressed. The allocation of the 70 publications is based on the structured literature data collection process in Annex A. The dimensions analysed are displayed below in **Table 4.2**.

Industry addressed by publication	Number of Publications (n=70)	Description of Publication	Conclusion
None	23	Theoretical concept, literature review, conceptual article	<p>High number of theoretical and conceptual contributions</p> <p>All of the industries that are researched from a BEs perspective are shaped by</p> <ul style="list-style-type: none"> - Industry developments/ high velocity developments - Variety of agents - Dependency among agents - Importance of interconnection among agents - Importance of innovation <p>- No research in the sport industry</p> <p>- Only little research in automotive industry</p>
Various	5	No specific industry, mainly global change and high velocity developments addressed	
Information technology	16	Software, computing and information technology. Importance of high connectivity among agents, high variety of agents , importance of platform of interaction	
Mobile industry	6	Importance of high connectivity among agents, high variety of agents , importance of platform of interaction	
Retail	5	Importance of high connectivity among agents	
Automotive (Electric vehicle)	3	Importance of high connectivity among agents, importance of innovation	
Semiconductor	3	High variety of agents, dependency among agents	
Aerospace	2	Meet market dependencies	
Pharmacy	2	React to industry developments	
Marine	1	High variety of agents	
Agri-food	1	Importance of collaboration for innovation	
Carbon Trading	1	Emerging industry development	
Solar Energy	1	Emerging industry development	
Academic sector	1	Importance of interconnection among agents	

Table 4.2: Industries addressed in business ecosystem publications

The results in **Table 4.2** show that only very little research has been taking place in the automotive industry and no research in the sports industry. As outlined in chapter five, these two industries were accessible for the research conducted. Consequently, the research gap can be addressed in these two industries. Additionally, publications focussing on the industries above were shaped by the selection criteria displayed in **Figure 4.6**. These criteria can also be met by the automotive and sports industry as indicated (indexed sources in **Figure 4.6** can be found in **Appendix E**). Building on these considerations the two industries selected are considered to be appropriate for this research.

Selection criteria	Automotive industry (Sources: S1, 2017-S5, 2017)	Sports industry (Sources: ID1, 2017-ID4, 2017; ID3, 2014; ID5, 1995)
Industry developments/ high velocity developments	x	x
High variety of actors	x	xx
Dependency among actors	xx	x
Importance of interconnection among actors	xx	xx
Importance of innovation	xx	x

Figure 4.6: Selection criteria derived from literature in business ecosystems

Case selection criteria was then used in for data processing to address suitable cases in the Sports and Automotive industry as displayed in **Table 4.2**.

Within the selected cases the aim was to look at the Keystone agent in one BE determined by certain network structures and to discuss the context of agents in that particular ecosystem rather than in a collection of ecosystems, in order find overlapping Keystone specifics and differences.

Due to the research approach, the research question, the data triangulation and multilevel analysis, the sources used for the multiple case study analysis included the traditional methods of documentation, archival records, interviews as well as direct observation of network meetings. Additionally, qualitative network mapping as a new method was developed to access each case on a network level and support the identification of the Keystone in combination with the other two

primary data collection methods interviews and observation. The following case study data collection methods were used:

- Network mapping
- Interviews
- Observation
- Secondary data analysis (Documentation, archival records)

In order to ensure the validity of data and the comprehensive approach to all levels of analysis, the following research strategy was developed for the case study. The research strategy shown in **Table 4.3** is only related to primary data selection and includes the expert interviews of research stage one as well. It also considers the data processing and analysis aspects that are outlined in chapter five.

Table 4.4 below summarises the overall research methodology framework introduced in this chapter.

Level of Analysis	Unit of analysis	Main Question of investigation	Data collection method	People investigated	Network situation	Data processing/ analysis
Network	Network relations/ dynamics between agents	Role identification Structural and relational characteristics keystone	Tie script (network mapping)	All actors	Informal and formal network	Qualitative data analysis (data analysis approach) Inductive and deductive coding into chunks of meaning (data analysis method)
Network and BE	Network characteristics and actor behaviour identification	BE definition and networks/ What Actors can be investigated? Role characteristics, context understanding	Expert Interview/ semi-structured	Network coordinator + three BE Experts on BE definition	No specific network structures	
			Observation	All actors	Informal network situations formal network situations	
Organisation	Influence of the organisation/ innovation/ strategy	What is the strategy? How are actors influenced?	Interviews/ semi-structured and open + Observation	Keystone, Niche player, Dominator organisations/ employees	More open network situations/ More closed network situations	
Individual level	Actor behaviour/ KS/ Strategy making	Why are they doing what?	Interviews/ semi-structured and open + Observation	Keystone individuals	Informal and formal/ closed and open network structures	

Table 4.3: Research strategy covering all levels of analysis

Aspects of the research methodology framework	Detailed aspects of the research methodology
Approach taken to address phenomenon	Inductive, qualitative approach to research/ phenomenological approach (Holden and Lynch, 2004).
Epistemological orientation	Relativism/ constructivism
Ontological orientation	Subjectivism
Method for data collection	Qualitative methods: Semi-structured interviews
Method for data processing	Qualitative data analysis: coding method into patterns of meanings (Saldaña, 2014)

Table 4.4: Research methodology framework

4.6.2.3 Network mapping

As already discussed above, the network level was at the case study level (Yin, 2014). In order to find two opposed cases and create a context variety, it was important to understand what network structures dominate in what case. Due to this variety it was ensured that the patterns of Keystone agents could be considered to be valid.

The network mapping tool was developed in relation to the idea of social network analysis (SNA). But whereas SNA concentrates on the quantification of social network relations in order to create a holistic picture of the network (Otte and Rosseau, 2002), the network mapping used in this work provided a first insight into the relations of particular network agents. SNA enables the researcher to access networked structures such as nodes, which can be individual actors or companies for example, and ties, edges, or links (relationships or interactions) that connect them (Scott, 2017). Furthermore, SNA can measure the strength of the ties and the exact position of the nodes. Even though this quantification cannot help to identify a certain BE or network agent, as these agents are determined by certain characteristics (Iansiti and Levien, 2004a), the main tool to access data in SNA, a network matrix, was considered to help in this research. It was used to ask for network aspects that enabled a better understanding of the Keystone role. **Table 4.5** shows the network mapping matrix that needed to be send out to all members of the case study network. Additionally, some questions were asked in

order to identify the Keystone role which was then triangulated by the interview and observation data.

A sample of a network mapping form is displayed in **Appendix D**.

Name of company/ Question asked	I knew the person before the network started	Relation is mainly build on contract we had or business we made together	Relation is mainly build on many meetings and conversations we had	Relation is mainly build on a friendship	The person is part of the founder of the network	We have very often contact	We have seldom contact	I often receives information or help when I asked for	The person is well connected to other networks
Company A/Person A									
Company B/person B									

Table 4.5: Network mapping matrix modified to access qualitative data

In order to conduct the interviews planned on individual level, the agent, being person and company, needed to be identified first. This was done by network mapping but also by observation of network meetings and interviews with other network agents to ensure the right basis for the unit of analysis.

All observations were protocolled, stored and coded accordingly.

As knowledge is shared by individuals and organisations (Nonaka, 1994) the individual was accessed first and then the company behind the individual. The characteristics introduced by Iansiti and Levien (2004a) outlined in **Table 2.2**, as well as the first findings deduced from the expert interviews, were used to identify the different agents. To ensure that the unit of analysis was addressed in-depth, a focus on the interviews with the individual agent was important. The individual person and the company needed to be investigated in regards to the actions and characteristics that enabled them to fulfil their role and share knowledge within the network structures. In order to address agent specific characteristics and actions, other network agents were accessed by semi-structured interviews. Additionally, open and semi-structured interviews with the individuals of the Keystone company were held to learn about their characteristics and actions that connect them with the agent company. Furthermore, interviews were conducted with other employees of the agent company, selected by accessibility, to triangulate the statements of the individual agent. Here, it was essential that the employees chosen worked closely with the Keystone individual and were employed for more than one year at the Keystone company. It was furthermore important that a range of interviews were











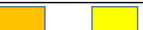
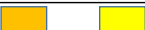




conducted to identify the agent individual and company and to address many levels of firm activities that are important for strategy making (Mintzberg, 1978).

4.6.2.4 Observation

As observation is an important method to gain deep insight into people's behaviour and action, for this thesis it was a key method to explore the Keystone role in CR. As it was important to not influence agents, the non-participating but direct observation method was chosen. As knowledge is also shared to a great extent by individuals (Nonaka, 1994), and agents are represented by individuals in networks (Brass et al., 2014), the individual behaviour was considered to be a key element here. An observation frame was developed that inherits the following aspects:

- Identification of Keystone person and company by Iansiti and Levien's (2004a) taxonomies and by expert interview findings
- Personal characteristics of the agent individuals
- Company characteristics of the agent company
- Actions relevant for KS
- Actions relevant for strategy development in the agent company.

Observation as a method is very helpful in combination with interviews, as a rich understanding of the case, as well as the agent company and individual person, can be obtained. Due to the direct observation method an in-depth understanding of the dynamics between the interacting individuals is possible (Saunders, Lewis and Thornhill, 2012). **Figure 4.7** shows the different research methods addressing the multilevel approach. It also shows how the different research methods can contribute to the different aspects of the main research question.

	Expert interview	Network mapping	Case study interviews	Case study observation
Business ecosystem level				
Data collection aims	<ul style="list-style-type: none"> - Agent identification - Business ecosystem structure (Structure) - Definition Network and Business ecosystem (context) 	<ul style="list-style-type: none"> - Agent identification - Agent relational and structural characteristics 	<ul style="list-style-type: none"> - Business ecosystem context - Agent relational characteristics 	<ul style="list-style-type: none"> - Agent relational characteristics
Network level				
Data collection aims	<ul style="list-style-type: none"> - Agent identification - Business ecosystem structure (Structure) - Definition Network and Business ecosystem (context) 	<ul style="list-style-type: none"> - Agent identification - Agent relational and structural characteristics 	<ul style="list-style-type: none"> - Network level context - Knowledge sharing in network 	<ul style="list-style-type: none"> - Agent identification - Network level context - Knowledge sharing in network
Company level				
Data collection aims	<ul style="list-style-type: none"> - Agent company characteristics 	<ul style="list-style-type: none"> - Agent identification - Agent relational and structural characteristics 	<ul style="list-style-type: none"> - Agent company characteristics - Knowledge sharing - Strategy and innovation aspects 	<ul style="list-style-type: none"> - Agent company characteristics - Knowledge sharing - Strategy and innovation aspects
Individual level				
Data collection aims	<ul style="list-style-type: none"> - Individual characteristics 	<ul style="list-style-type: none"> - Agent identification - Agent relational and structural characteristics 	<ul style="list-style-type: none"> - Individual characteristics - Knowledge sharing - Strategy and innovation aspects 	<ul style="list-style-type: none"> - Individual characteristics - Knowledge sharing - Strategy and innovation aspects





Structure	
Process	
Context	
Content	

Figure 4.7: Different methods contributing to research question and multilevel perspective

4.6.2.5 Focus of case study: Keystone agents in network structures

During preparation of expert interviews and case study data selection process, it became obvious that a concentration on the Keystone agent, being one of the central agents within the network or BE structures, was a good choice as it enabled a focused case study research. Furthermore, findings related to the Keystone agent were also expected to reveal knowledge related to other agent roles as the Keystone does not act in isolation. Especially as the Keystone agent is supposed to provide a platform of interaction (Scaringella and Radziwon, 2017) for other agents, an analysis of the Keystone agent does prospect an insight into other agent's behaviour. Due to the concentration on the Keystone agent, an in-depth analysis of expert interview and case study findings could be provided. As BE studies describe the Keystone as being the critical agent that keeps the ecosystem alive, that manages the exchange platform and that influences dynamics (Iansiti and Levien, 2004a; Mäkinen and

Dedehayir, 2012; Rong et al., 2010; Rong and Shi, 2015; Den Hartigh, Tol and Visscher, 2006; Isckia, 2009; Quaadgras, 2005), the focus on the Keystone agent was kept. Expert interviews and observation in the case studies were aimed to support that decision, as it was expected to get the most data from this agent type suspected to be the main influencer of network dynamics.

4.7 Summary

Beside research philosophy and methods, this chapter provided an insight into the research strategy, design and methods as well as research ethics. As this work is based on an exploratory and qualitative approach, a detailed and comprehensive overview on philosophical matters, data collection methods, and distinct research stages has been outlined in this chapter. Furthermore the research process was outlined in order to provide a frame for the actual data collection and processing steps outlined in the next chapter.

5. Data collection and processing

This chapter presents an overview about data selection and data collection as well as data processing as the basis for analysis. Subsequently, the analysis and interpretation of the data is undertaken in the next chapter. Here, in the data collection chapter, the research strategy is becoming alive and all action taken to select the data and answer the research question is explained. Therefore, a detailed prescription of the procedures that were followed is provided. As qualitative data is ‘information gathered in non-numeric form’ (Easterby-Smith, Thorpe and Jackson, 2015, p.129), all of the data collection procedures in this chapter describe the collection of data as words. That means that all collected data was recorded and transcribed as documents and then processed by a structured content analysis (Miles, Huberman and Saldaña, 2014). Coding as data processing method was used (Saldaña, 2009), in order to generalise chunks of qualitative data into patterns of meaning (Miles, Huberman and Saldaña, 2014). This provides an exploratory way to enhance theory building (Easterby-Smith, Thorpe and Jackson, 2015). The data procession is explained elaborately in the second section of this chapter.

5.1 Data collection approach

As data collection needs to take place alongside the developed methodology and the predefined research strategy, it is very important to have clearly defined research questions and a well-developed research framework (Miles, Huberman and Saldaña, 2014) to keep the data collection procedure close to the data really needed. How methodology, method as well as research question and the research framework belong together has been explained in detail in the methodology chapter. The procedure for developing the interview and case study access, how the case studies were carried out and how Keystone agents were identified and accessed are comprehensively discussed in different sections in this chapter. For the later data analysis it is important to consider that the data collection process itself is already a selective process that requires a careful data selection procedure (Miles, Huberman and

Saldaña, 2014). Consequently, the data selection process deserves a detailed protocol of all steps initiated (Creswell and Poth, 2018).

First of all, one central problem of research is the opportunity to gain access to the data needed, a challenge for all field researchers (Shaffir, Marshall and Haas, 1980). In this study careful pre-selective field analysis was undertaken in order to meet that problem. Furthermore, a research proposal was created for data access that allowed a polite and informative first contact with possible research participants. The research proposal included, as suggested by Easterby-Smith, Thorpe and Jackson (2015), a short introductory section; an overview of what kind of data is collected and how; information and summary about the researcher's background and motivation; a section dealing with data protection and confidentiality. The research proposal and the introductory section are displayed in **Appendix B** and **C**.

In order to identify potential 'gatekeepers' (Easterby-Smith, Thorpe and Jackson, 2015, p.176) for the data needed, the internet was investigated to learn more about innovation networks in Germany. Innovation networks were decided to be a possible object of analysis as KS is particularly important for innovation (Corsaro, Cantu and Tunisini, 2012). Especially when it comes down to new idea generation, networks are important to create the heterogeneity needed for new knowledge input (McEvily and Zaheer, 1999; Van de Ven, 1986). Furthermore, network structures were considered to be a good starting point to find Keystone agents and investigate his connections as well as to find out about the BE and the network the agent belongs to. This was particularly important as BE structures are not possible to delineate or to map (Butel, 2014). The entry point was therefore chosen to be in accessible network structures as already outlined in the chapter four. The accessibility was facilitated when the network structures were institutionalised, for example by a name or logo for the network entity.

It was decided early that the field investigation should take place in one country only, as innovation in different market economies takes place differently. Soskice and Hall (2001) introduced the idea of coordinated market economies, being for example Germany, Japan and Sweden, and liberal market

economies like the Anglo-Saxon countries. This also affects their ability to innovate disruptively or incremental due to the regulation policies in that very countries. As Germany has strong funding policies, innovation networks are often build up by a funded institution first rather than developing on their own by independent collaboration (Czarnitzki, Ebersberger and Fier, 2007). In order to meet that particularities and to reduce complexity, the case study analysis was chosen to be conducted in one country only. Due to funding policies, a high variety of innovation networks exist in Germany, consequently it was chosen as the country of investigation. Furthermore, Germany has a very strong funding scheme for innovation networks that was developed to enable innovation development and KS between Small and Medium-sized companies (SME's) and big companies (VDE and VDI, 2016). As this funding scheme is well known and supported by different German State Ministries, in order to meet new global challenges and developments, such as the digitalisation of different industries (VDE and VDI, 2016), it was decided to look for potential innovation networks that has been funded by the VDE, VDI Funding Scheme. VDI, VDE is an organisation that applies governmental funding schemes, for example the scheme central innovation SME (VDE and VDI, 2016). It was important to find networks that were in the funding scheme in the past, acting now without any governmental influence. This was due to distinct network dynamics that could take place without any governmental influence in order to generate appropriate data. Competition and collaboration dynamics are influenced when one well connected actor, such as for example the governmental network management, predominates relationships (Cygler, 2010). Especially, as the Keystone role was identified by triangulation of different data sources, it was important that his actions and characteristics were purely visible without any actions that serve governmental requirements. Former VDI, VDE funded networks were considered to be a good basis to find innovation seeking networks that had a particular interest in sharing knowledge. The funding scheme is set for three years, it was therefore necessary to find networks that has been funded in the past but were still existent due to their own effort and interest. In order to gain information about that possible cases, 10 open telephone interviews with governmental network managers were conducted to find still existing

innovation networks that were not any more governmentally funded. The governmental network managers were relevant, because they are occupying an administrative position in the network. So they are well informed about the actual funding structures in the network itself and across the network boards into other innovation networks. During the telephone interviews the opportunity was used to address questions about networks and their characteristics to understand more about the context created by the theoretical framework developed in the literature review chapter, in order to proof that the access chosen to be on the network level was the correct approach.

Building on the case selection criteria explained in the methodology chapter, typical-case sampling suggested by Easterby-Smith, Thorpe and Jackson (2015) aiming at most typical instances that define the cases was used. In order to increase the generalisability of the multiple case study, two cases were selected that were opposed to each other in regards to relational structures. The case selection criteria are displayed in **Figure 4.5 and 4.6**. Both cases oppose each other in terms of their relations dominating the network structure. One case is dominated by informal relations, the other case by formal relations. The context of the networks differ as well, one being in a stable but competitive, high-velocity (sports-) industry and one in an unstable industry (automotive). Also, a third case was selected that was chosen due to its mixture of formal and informal relations being a case in the middle of the other two cases. During the study, the case could not be investigated further as the research is always dependent on the volunteering of participants and the participants of the third case did not invest any time to get back with the requested material. Due to the lack of data richness (Miles, Huberman and Saldaña, 2014) it was decided to go ahead with two case studies instead.

During the case selection period it was noticed that a preliminary study with experts was to be conducted first in order to reconfirm the developed framework as the context for Keystones acting in network structures and BEs. Therefore, seven out of the 10 governmental network managers were accessed that has been already talked to for the case selection. Further investigation around governmental funds revealed the European Union (EU) funding scheme of ecosystem structures (Innovation Scoreboard, 2016). Three experts of that scheme were addressed additionally to the

network managers. One expert of the EU funding scheme was based in Italy and chosen due to due to high efforts his region investigated into the scheme. The detailed expert interview selection process is explained further down below.

The network manager was used as a gatekeeper and identified the persons to address when attending the network meetings of the selected cases. Network meetings were very important in the approach as visual data was gained additionally to the spoken word. This was particularly important in order to identify the Keystone and therefore the subject of further in-depth investigation. At the same time as the attendance at the network meetings took place, a network mapping interrogation was conducted, which was used to support the visual role identification of the Keystone and to explore structural and relational characteristics of the Keystone company. Additionally, former network managers were interviewed to triangulate the Keystone identification. Furthermore, expert interview findings were used to support the Keystone selection criteria.

As soon as the Keystone had been identified as the Keystone person, other employees of the Keystone company and other members of the networks were interviewed and talked to in order to identify Keystone characteristics and actions. This was supported by parallel observation of the network meetings.

All these different steps of data collection were built on each other, supported by the research strategy developed in the methodology chapter. By using the different methods parallel at the same time, asking similar questions to different people the laddering technique as well as feedback loops were used to support the quality of data (Easterby-Smith, Thorpe and Jackson, 2015). The detailed data collection process is displayed in the next sections. All methods and their aims are furthermore displayed in **Figure 5.1**.

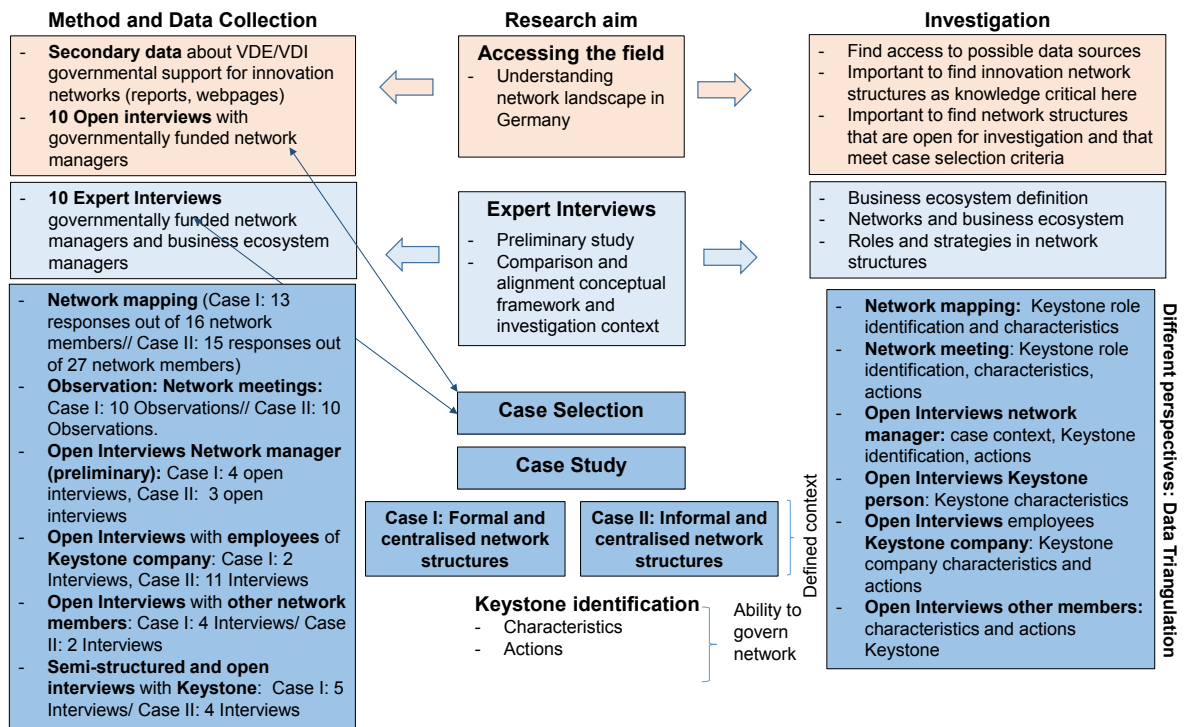


Figure 5.1: Research aims, methods and investigation

5.2 Data collection process

The data collection process began with data collection through conducting open interviews with governmentally funded network managers to enable access to the networks. They were chosen as multipliers as they had experience in working with networks and they could provide information about still active innovation networks. As shown in **Figure 5.1** the first 10 open interviews were conducted to find possible case studies to be investigated and experts for the expert interviews. During the data access period a topic guide (Easterby-Smith, Thorpe and Jackson, 2015) was developed to address questions that were generated alongside the requirements for the case studies. Addressed topics were:

- the funding of the network (as it needed to be without governmental funding)
- the development of the network and continuance of existence (without governmental funding)
- industry specifics (being stable or unstable developments)

- interest of the network in innovation (need of KS)
- success of innovation (development of innovative products)
- heterogeneity of partners
- network activity (frequency of interaction)

Frequency of interaction was determined by the frequency of regular meetings. Networks that had meetings only once a year were not considered to be active. Case study research needs to be guided by theoretical aspects and the research question (Ragin and Strand, 2008) as well as real life requirements. The addressed topics listed above consider this theoretical, research and real life aspects. Furthermore, it is also important to consider that cases need to have areas of homogeneity where they overlap and are comparable on the one hand, considering a certain conceptual space displaying heterogeneity on the other hand (Ragin and Strand, 2008). Both aspects were taken into account when the cases were selected. During telephone interviews all the above listed aspects were frequently addressed so that the networks could be listed in a selection criteria list. **Table 5.1** shows an example of the selection criteria list. In order to choose the best fitting case, the main case selection criteria developed during the literature review and displayed in **Figure 4.5 and 4.6** were then taken to choose the two main cases of investigation. The period of accessing the field took place from March 2016-April 2016.

	Network I	Network II	Network III	Network IV
Industry Environment/ Business ecosystem stability				
Funding				
Activity of members				
Network architecture				
Central firm influence				
Network governance mechanisms				
Knowledge sharing mechanisms				
Relevance of Innovation				

Table 5.1: Selection criteria's and topic guide developed during open interviews

5.2.1 Expert interviews

At the same time as the case selection took place, experts were sought for expert interviews, in order to verify the framework developed in theory and displayed in the literature review. It was important to understand the connection between networks and BEs better, as this defined the context for the investigation of the Keystone. Furthermore, the existence of different roles and their characteristics needed to be understood in more detail before in- depth interviews with single firms could take place. It was decided to conduct a semi-structured interview and questions were developed alongside the conceptual model. The conceptual model was generated to support the understanding of BEs and networks, as well as the characterisation of roles and their interest in KS. It was necessary to understand how BEs are structured and how their connections are built up in order to comprehend agent roles, their strategy making and KS. Additionally, an open interview part was added to allow greater interviewer flexibility (Rosnow and Rosenthal, 2008). Expert interviews were conducted between May 2016 and August 2016. The innovation network support programme of the state of Germany (VDE and VDI, 2016) was used to address the experts. A number of networks were identified that were initially established by the state and are now operating independently within their industry or regions. Three experts of state governments working in EU programmes and seven experts on innovation networks were interviewed. They defined BEs and networks, different CR, agents and knowledge shared in that structures. Altogether, ten interviews were conducted. The selection of interview partners is shown in **Table 5.2**. Each interview lasted approximately 60 minutes, was audio recorded and transcribed manually (Wulf and Butel, 2017).

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Table 5.2: Selection of expert interview participants

(Source: Wulf and Butel, 2017)

5.2.2 Case study

The cases were selected following the predefined selection criteria for suitable cases as shown in **Figure 4.5**. **Figure 5.2** below displays what industries were selected and how the predefined categories were fulfilled. In both cases the Keystone role is in the centre of investigation. A centralised network structure is chosen with a strong central player for both cases, to ensure a certain comparability. In contrast, and in order to investigate differences in Keystones, distinct industry backgrounds are selected. While the industry of **Case I** is shaped by uncertainty and instability, the industry of **Case II** is considered to be stable but it is still shaped by fast strategic decision making due to technology developments in elite sports (Eisenhardt, 1989b). Innovation in the field is driven by elite sports technology evolution that are shaped by high-velocity changes of trends and by globalisation challenges. Therefore, in both industries companies are required to quickly adapt to current developments and to innovate. Stable means here, that no large-scale disruptive changes take place. The industries and the specifics of both cases are explained in detail in the case study chapter. **Case I** and **Case II** were not investigated entirely simultaneously. Whereas the investigation of **Case I** started in April 2016 and ended in May 2017, **Case II** started in June 2016 and ended in July 2017.

Due to analysis taking part throughout case study investigations some findings and developments of **Case I** could be used for the investigation of **Case II**.

Variety factors	Case I	Case II
Roles investigated	Keystone	Keystone
Industry environment/ Business ecosystem stability (development stage)	Unstable (automotive industry, instability due to current developments around autonomous and electric cars)	Stable but high-velocity developments. (Elite and wide sports industry. Elite sports is shaped by a strong competitive environment)
Network architecture	Centralised (embedded and centralised network structure due to big OEM who creates economic dependency among network members)	Centralised (embedded and centralised network structure due to central firm engaging in network management)
Central firm influence	strong	strong
Network governance mechanisms	More formal than informal mechanisms (high economic dependency) No direct governmental influence as not governmentally funded.	More informal than formal mechanisms (formal contracts for network membership but no economic dependency, many existing friendships) No direct governmental influence as not governmentally funded.
Knowledge sharing platform	Closed No access to the network without application and assessment center Certain meetings are open for everyone	Open Everyone can attend network meetings when shortly discussed in advance

Figure 5.2: Case study selection and case specifics

In order to understand the Keystone player, not only in network structures but also in BE structures, it was important that the network was placed in an acquainted BE. The BE was identified by using definitions introduced in BE literature. BEs being a unit of interrelated and interdependent firms (Fox, 2013), acting within and being dependent upon their environment (Rong et al., 2010), bound together by a mutual aim or a shared vision (Iansiti and Levien, 2004a). Seeing them as being shaped by network structures, forming a bigger structural entity than networks (Wulf and Butel, 2017) with blurred boundaries. Concentrating on roles within a BE means also that research is not concentrating on defining the boundaries of the BE, as this is seen as enormous academic exercise not helping to understand the dynamics of the system (Iansiti and Levien, 2004a; Heikkilä and Kuivaniemi, 2012). The BE was identified by asking network managers for BE specifics when networks were sought for investigation as shown in **Table 5.1**.

Although the unit of analysis is the individual person and the company shaped by a multilevel perspective (Eisenhardt, 1989a), the entry point of the investigation was the network level (Yin, 2014). After the careful case selection, case study research started with simultaneous investigations,

being network mapping, observation and open interviews with network managers. The reason for the parallel investigation was the importance of Keystone identification, in order to be able to collect data related to the Keystone role from the beginning on.

The term network mapping is normally related to SNA where matrix inquiries are send out to all members of the network in order to map out all connections as well as the degree of interaction and centrality for all network members (Wasserman and Faust, 1994). SNA shows the complexity of a network as well as the overall structure but does not investigate at the company or individual level where a lot of interaction takes place (Berthod, Grothe-Hammer and Sydow, 2017). Berthold, Grothe-Hammer and Sydow (2017) therefore suggest that networks should be investigated by an ethnographic approach to understand the individual actor within the system. So far network mapping has been only used for SNA analysis and not as a qualitative approach. As the network mapping approach was used as a supporting tool for data triangulation, it was considered a useful assistance to address all members of the network. As the role of the Keystone was investigated on individual and company level, the network mapping tool was a way to identify the Keystone in the network corresponding to major investigation aims displayed in **Figure 5.1**. The network mapping matrix is displayed above in chapter four, **Table 4.5**. To enable the identification of the Keystone agent not only through the position and relations maintained, a network mapping introductory sheet was provided to all network members asking for the person that keeps the network alive, **Figure 5.3**.

In order to understand the strategic relevance of the network to the individuals and companies investigated, the first two questions were added to the introductory sheet. Additionally, the importance of networking was addressed by asking if the companies or individuals are active in other networks as well. Introductory sheet and network mapping matrix were jointly sent to all network members.

You need the network in order to reach your company goals or targets?

Yes ☐

No ☐

The network is important to align your company strategy to upcoming events?

Yes ☐

No ☐

Are you active in other business networks as well?

Yes ☐

No ☐

Can you identify someone to be a triggering person of the network (someone who keeps the network active and alive)?

Yes ☐

No ☐

Can you name the person?

Figure 5.3: Network mapping introductory sheet

Both cases contain a different number of members. The membership was defined by accessing the webpage of the network where logos and company names were listed and by member's frequent attendance of network meetings. The network mapping document was sent out via email to all members. For **Case I**, 13 responded out of 16 network members. For **Case II**, 15 responded out of 27 network members. This means a response rate of 81% for **Case I** and 55% for **Case II**. The aim of the network mapping was not the complete representation of the network or the quantitative measure of for example tie strength as normally in SNA (Berthod, Grothe-Hammer and Sydow, 2017). It was rather used for the identification of the Keystone and his specifics. Therefore, the response rate was not as important as it is for the SNA. It was essential to understand where the Keystone is roughly located in the network, and what his main relational and structural characteristics are. This was possible by working with the response rate given. As shown in **Figure 5.4**, where an example is presented, the relations uncovered were able to show the centrality of actors asking for different kinds of relations. It was asked not only for long-standing relations but also for formal relations, relations

built solely on interaction, relations built on friendship as well as for the activity of certain actors (such as being a founder of the network, being an information provider or a bridge to other networks). It was possible to display all findings in different network maps and matrixes, which are explained in the findings chapter. Overall, the network mapping was used to triangulate the identification of the Keystone as providing one source for identification, as well as defining some of his characteristics. It was therefore a helpful supporting tool for the other data collection methods.

Question I: I knew person before the network started

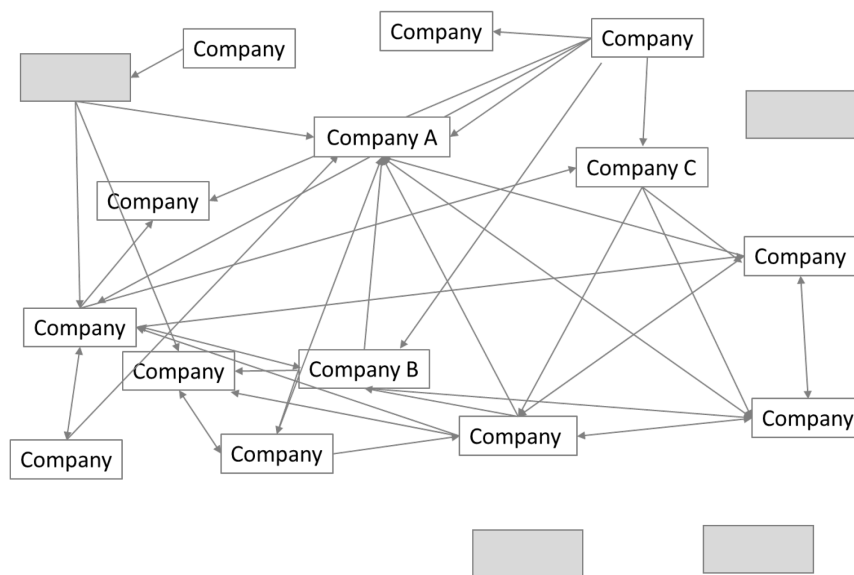


Figure 5.4: Network mapping exemplary outcome

As in case study research inter-weaving data collection as well as simultaneous analysis of data is essential (Miles and Huberman, 1994), network mapping analysis was conducted during the main data collection process between May 2016 and May 2017.

Another method used was the observation method by frequently attending network meetings. Words alone cannot describe complex situations and the observation method is particularly helpful to describe visual impressions and settings (Easterby-Smith, Thorpe and Jackson, 2015). Therefore, observation was considered a useful tool to understand Keystone characteristics and behaviour. In order to investigate the networks and not affect their dynamics, the observer did not influence the network meeting setting. The participant role was chosen as direct and uncovered but non-influencing

observation (Miles, Huberman and Saldaña, 2014; Easterby-Smith, Thorpe and Jackson, 2015). As the observation method was selected to gain a deeper insight into the behaviour of network members and the dynamics taken place within the network structures, it was important to attend more than one network meeting of each case. Depending on the willingness of network members, as well as the frequency of meetings, it was possible to attend 10 network meetings for **Case I** and 10 for **Case II**. Field notes were taken during and right after the observation took place. Every network meeting created around 10 pages of field notes and gave insights into the characteristics of Keystones and characteristics of other network members. Actions observed during one meeting could be followed up and verified during the next network meeting. This enabled to validate the Keystone intention to do something and to observe what he really did. Besides the findings the research questions aim at, some findings could be generated about other roles played in the network and their interaction with the Keystone. These interdependencies are outlined in the case study chapter.

Parallel to the observation of network meetings, regular open telephone interviews with network managers took place. In **Case I** the network manager was not formally engaged in the current network anymore but was still informally connected with participants. Furthermore, the network manager had a deep insight into developments as he knew the network from the start. As a governmentally funded network manager he was also still involved into information exchange between former and still active agents. Regular contact to this former network manager ensured an outside view on **Case I** that enabled to align observations of characteristics and actions with an outside perspective. This outside perspective was particularly helpful as it was shaped by insight knowledge due to the manager's former network participation. During the open interviews a topic guide was developed by the laddering of similar questions tagging always the same areas of interest. The topic developed as being the following:

- the development of the network
- members influencing the network dynamics
- actions and certain characteristics of this members.

This topic guide was then used for all open interviews undertaken with the network manager and other network agents of **Case I** and **Case II**. The network manager of **Case II** could not provide an outside perspective. Here, he was part of the Keystone company but not acting as a Keystone person. Overall, frequent open interviews using the topic guide, helped to understand observed actions and characteristics of the Keystone. Altogether, six open interviews were carried out for **Case I** and 14 for **Case II**. All interviews were short and used mainly to address the topic guide and reevaluate observation data.

All three data collection tools helped to work on the Keystone identification as **Figure 5.5** shows.

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Figure 5.5: Keystone identification through method and data triangulation

(Source: adapted from Iansiti and Levien, 2004a)

Figure 5.5 displays the Keystone description adapted from Iansiti and Levien (2004a) in the first row and the methods chosen for Keystone identification in the following rows.

The final phase of the case study investigation resulted in an in-depth study of the Keystone person and the Keystone company. After triangulation of Keystone identification it was possible not only to

identify the Keystone person and the company he was working for, also a first set of actions and characteristics were developed. This step helped to develop first characteristics of his role that could be implicitly asked for in the planned in-depth open interviews. It was important to triangulate the first set of characteristics and actions discovered during the first part of the case study analysis. In order to reach a broad range of data, it was decided to address not only the Keystone person but also employees of the Keystone company and other network members. The first two Keystone interviews with the same Keystone person were conducted in a laddering technique to find the most important themes that could reveal actions and characteristics of the Keystone identifying and characterising his role. It was found that influence in the network and the network development were main themes, which were also addressed frequently in the open interviews with network managers. Consequently, critical incidents were developed (Saunders, Lewis and Thornhill, 2012) based on network managers interviews, as well as network agent interviews, in order to monitor and understand the developments and the influence of the developments by the Keystone. After the first two Keystone interviews a topic guide was developed together with network manager interview findings. The topic guide enabled to ask for certain patterns that help to develop theory in a later stage (Eisenhardt, 1989a). The topic guide is displayed in **Appendix G**, showing not only the topics but also the addressed interviewees.

Altogether, for **Case I** it was possible to conduct five Keystone interviews, two employee interviews and four interviews with other network members. For **Case II** four Keystone interviews, 11 interviews with Keystone company employees and two interviews with other network members were realised. In order to enable an in-depth Keystone company investigation, it was important to access secondary data as well. Especially, historical data pointing at certain network and company developments can be accessed well through secondary data (Easterby-Smith, Thorpe and Jackson, 2015; Bryman and Bell, 2015). Documents about the Keystone company and the network were selected additional to official network meeting protocols, documentation about past innovation developments and strategically relevant documents. Furthermore, the employee open interviews provided an important

source of information about the Keystone company. Therefore, a comparison between researchers view and other information sources were made (Bryman and Bell, 2015).

All data collected in the first stage of the research, being the expert interviews, and the second stage of the research, being the case study research, has been stored as documents and ordered chronologically in digital folders. The next section shortly outlines the data processing method. Actual data processing and analysis is then explained in more detail in the findings chapter.

5.2.3 Data processing and analysis

In order to reduce and systemise data to enable its display, it needs to be processed in a systematic way (Miles and Huberman, 1994; Kuckartz, 2007; Saldaña, 2009). Content analysis is one way to draw systematic patterns from data (Easterby-Smith, Thorpe and Jackson, 2015). Coding is the method of choice in content analysis to reduce the data to patterns of meanings, named codes (Kuckartz, 2007; Saldaña, 2016), and chunk the written word into paragraphs of meanings (Easterby-Smith, Thorpe and Jackson, 2015). Codes are then structured to categories and categories to themes and concepts that create meaning on an abstract level (Saldaña, 2009). Miles and Huberman (1994) describe that data from codes can be collected deductively and inductively, or both, depending on the research approach. A grounded theory approach (Glaser and Strauss, 1998) concentrates on non-pre-defined data collection with codes developing from the set of data available. Deductive approaches develop a certain set of categories before the data analysis starts and examines the available data for meanings that belong to the pre-defined codes and categories (Miles and Huberman, 1994). King (2012) introduced the template analysis that suggests a template of codes and categories adjusted to the conceptual research framework that is then extended by the data that has been collected (King, 2012). He therefore combines deductive and inductive approaches. Additionally, Miles and Huberman (1994) suggest that inductive and deductive approaches can be combined depending on the data collected and the way the researcher wants to access the systemising of data.

Coding is always yet an analytical process which means that data is already addressed in a selective way (Saunders, Lewis and Thornhill, 2012). Because of that, it is important to develop a data analysis approach that fits to the overall approach of the researcher and how he sees the world (Easterby-Smith, Thorpe and Jackson, 2015). Coding itself is a long process that needs to consider different types of codes as well. In order to understand multiple meanings of codes, researcher suggest two stages coding, meaning a first cycle-coding on a descriptive basis and second cycle-coding that is useful to understand relations between categories and even codes (Easterby-Smith, Thorpe and Jackson, 2015). Additionally, different codes can be introduced like descriptive codes, displaying the main meaning of data chunk, the interpretative code, meaning a code that is already generalised to a certain meaning, pattern codes, that describe connections and relations between codes, and cross pattern codes, which describe same or distinct meanings between cases (Miles and Huberman, 1994). Especially in multiple case studies it is important to look for commonalities and distinctions, in order to understand generalizable data and draw conclusions (Eisenhardt and Graebner, 2007). **Figure 5.6** shows how the data systemising and reduction process can take place. How data systemising, reduction and analysing took place in this study is explained in the analysis chapter in more detail. Here, the case study specifications are taken into consideration throughout the analysis process as well.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 5.6: Data reduction and systemising process

(Source: adapted from Saldaña, 2016)

In order to enhance quality, self-reflexivity and transparency during the entire research process needs to be provided (Easterby-Smith, Thorpe and Jackson, 2015). To provide transparency, the researcher needs to have good and well-prepared data. Data that is collected and processed in a transparent way is vital for the quality of qualitative research (Mayring, 2015). To ensure good quality every step that was done for the data collection and the methodology chapter was documented. All steps undertaken were specified in this chapter. This was done not only for the data collection process but as well for the data processing and analysing process. Self-reflexivity and transparency of the process is continued in the best possible way in the analysis chapter.

5.2.3.1 Expert Interviews data processing and analysis

Data processing and analysis of the expert interviews was done alongside Saldaña's data reduction and systemising process (Saldaña, 2016) shown in **Figure 5.6**. Altogether, ten expert interviews were coded and 170 pages containing 90.200 words were analysed. Following Miles and Huberman (1994) the codes were developed deductively and inductively during the coding process. Deductive codes were derived from literature, considering the main themes that shaped the literature review and from the main interview sections of the semi-structured interviews. Main interview sections were BEs, networks, interaction and interdependence in CR, roles in CR and KS in CR. After a first data

screening, the subcategories were developed inductively. All categories and subcategories are displayed in **Figure 5.7**. When all codes were allocated to the subcategories they were divided into bulks of meaning. Key statements resulted out of that bulks and are displayed and related to theory in the findings chapter. Through forward and backward control during the process by validating the coding categories, human errors were mitigated. Data saturated at interview number nine and the last interview proofed the correctness of the saturation point (Strauss and Corbin, 1990). All key statements listed in the findings chapter were used for the next step of data access, collection and analysis. As the expert interviews were expected to give insights into the definition and demarcation of network and BE structures, as well as the role of the Keystone agent, they were considered to give a first insight to better structure the data collected during the case study investigation.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 5.7: Data reduction and systemising process of expert interviews
(Source: adapted from Saldaña, 2016)

5.2.3.2 Case Study data processing and analysis

For case study analysis, again data processing and analysis was done alongside **Figure 5.6** Saldaña's (2016) data reduction and systemising process. As two case studies were conducted, the process of data systemising and coding, category deduction and induction was realised twice. The same coding categories were used for both cases to ensure a comparability during the cross-case analysis. Not all categories could be filled by the same amount of data or with the same density as the two cases had a slightly different emphasis. Additionally, not exactly the same kind of interviewees and not the same network agents could be accessed in both cases. As shown in **Figure 5.1**, the number of observations, semi-structured and open interviews on distinct levels differed. Nevertheless, despite a slightly different emphasis of both cases, the data accessed overall contained a similar repetition and thickness (Saldaña, 2016; Strauss and Corbin, 1990). **Figure 5.1** also shows with whom what topics were addressed. Often open interviews took place after official network meetings, which were attended through observation. Especially, the open interviews were often conducted in informal settings, such as during coffee breaks or after work dinners.

The observations and the semi-structured interviews were conducted in more formal settings such as meetings rooms or offices. Different meeting participants were attending the meeting throughout the period of data collection between June 2016 and July 2017. Due to the length of study and the great variety of methods chosen, nearly all network participants were met during the period of investigation. Only the network participants that were interacting closely with the identified Keystone person were included in open interviews, such as Niche players, network management and dominating companies (Iansiti and Levien, 2004a). By addressing network members that were near to the Keystone person, and in close contact, the interview data could mitigate a selection bias as numerous and distinct informants contributed with their views to focal phenomena (Eisenhardt and Graebner, 2007). All details about the networks chosen and their participants are listed in the case study chapter.

The data processing and analysis process of the case studies is displayed in **Figure 5.8**. The process was the same for both cases to ensure a better comparability of data collected (Eisenhardt and

Graebner, 2007). Providing a transparent data procession and analysis process is key for qualitative data sets. Especially, as researchers questioned the validity and reliability of qualitative data throughout its history (Yin, 1981). In order to avoid misunderstandings and to display how theory was inducted, all steps of the data processing and analysing framework need to be outlined. Also this enables the systematic use of cross-case comparison techniques (Eisenhardt and Graebner, 2007). Miles and Huberman (1994) suggest that the coding scheme needs to be structured and logical and should refer to the framework that has been developed during literature review. All steps undertaken during data processing and analysis are shown in **Figure 4.4** and described below.

In order to prepare the data for coding, all data collected was audio recorded, transcribed and coded manually. All investigations undertaken are also displayed in **Figure 5.1**. Altogether, **Case I** contains 22 documents of primary data. 6 open interviews (with Keystone person, Niche player, Dominator, Keystone company employees), 5 semi-structured interviews (with Keystone person, Niche player, Dominator, network management) 10 observations (of network meetings) and one email from a Keystone about network development, which are altogether 98.000 words that were coded and analysed. The network investigated in **Case I** developed just before the study started and some interviews were conducted with members of the old network out of which it developed and are part of **Case I**.

Case II contains 27 documents of primary data. 14 open interviews (with Keystone person, Niche player, Dominator, Keystone company employees), 3 semi-structured Interviews (with Keystone company employees), 10 observations (of network meetings) which are altogether 51.000 words. In both cases, the saturation point of data was reached after having conducted 3/4 of both studies. They were then extended for another few weeks in order to proof the correctness of the saturation point (Straus and Corbin, 1990).

Additional to the primary data set, secondary data was collected. As with primary data, secondary data should be collected following a certain research strategy, which ensures that the data is not outdated and from suitable sources (Boslaugh, 2000). Secondary data could be any kind of document

that serves to give additional insight into the case and answer the research question (Eisenhardt, 1989a). Secondary data for **Case I** and **Case II** was collected solely from network member company websites or websites dedicated to the network investigated. Additionally documents served by network members or Journal articles contributing to industry facts about the industries the networks are located in were explored. Secondary data was screened and mainly used to provide a comprehensive introduction of the cases studied and the companies investigated.

Primary data processing and analysis was started with an in-case analysis. Data collection, process and analysis took place simultaneously (Miles and Huberman, 1994; Eisenhardt, 1989a). As a first step of the in-case analysis, all data was screened by sighting every document that belonged to the case to become an overview of the case as ‘stand-alone entity’ (Eisenhardt, 1989a, p.540). A first level coding as displayed in **Figure 5.8** was then conducted by coding statements out of the documents created from transcription of the audio records. The statements developed out of the first round of coding were allocated to the deductively derived main categories and inductively developed subcategories. “This process [of first allocation] allows the unique patterns of each case to emerge before investigators push to generalize patterns across cases” (Eisenhardt, 1989a, p.540). This overview of the single case, when the same coding categories are used for both cases, was done to enable better comparability. Inductive and deductive coding was combined as subjects of the literature review were looked for in the data set to match the existing framework (Miles and Huberman, 1994; Eisenhardt, 1989a) and inductive coding subcategories were developed to match existing data to the categories (Saldaña, 2016). The combination of deductive and inductive methods can help to link data to existing theoretical concepts, indeed inductive and deductive methods can be a mirror of each other (Eisenhardt and Graebner, 2007). As **Figure 5.8** shows, the more the data is processed, the more it becomes generalizable. Therefore, the first level coding was essential to underline the differences of both cases that could help to develop cross-case analysis (Eisenhardt, 1989a). As all coding needs a certain revision (Miles and Huberman, 1994) and coding is done in repeating loops (Eisenhardt, 1989a) all categories and subcategories were scanned in a second level

coding in order to delete doubled categories and ensure that codes with multiple meanings were allocated correctly (Miles and Huberman, 1994). The second level coding enabled the researcher to simplify the first level coding, as subcategories that were developed inductively were found to be overlapping and complex. Therefore, the second level coding helped to create data of a greater density as the data in the first level coding was rather 'extended text', extensive and poorly ordered (Easterby-Smith, Lyles and Tsang, 2008; Miles and Huberman, 1994), than well distributed data sets. During both coding processes data was labelled so that its distribution to categories could be comprehensible (Easterby-Smith, Lyles and Tsang, 2008). After these two steps, two important documents for every case existed. The first level coding document, which offers a complex insight into the data of both cases and which enables to get further comparative meaning by case comparison at a later stage, and the second level coding document which already displays a first data set for the results chapter. The next step, the cross-case analysis ensured another level of abstraction and is essential for the analysis of multiple cases (Eisenhardt, 1989a). This procedure is explained in more detail in the cross-case analysis section.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 5.8: Data reduction and systemising process of case study analysis

All coding levels displayed in **Figure 5.8** serve a certain aim and are needed throughout the whole research process. They are a mixture of inductive and deductive coding categories. Central to multiple case studies is that they need to balance storytelling with generalisability (Eisenhardt, 1989a). In order to be able to compare case, a certain generalisability is needed but case specifics are still important. As theory developed from cases is shaped by repetition and every case is his own analytical element, the theory building need to take place through 'recursive cycling among the case data' (Eisenhardt and Graebner, 2007, p.25) especially as the closeness to original data sets keep researcher near to the reality. Because of this replication logic by different degrees of generalisation, due to the need of comparability multiple cases can develop better theory than single-case research but data sampling and analysis is more complicated (Eisenhardt and Graebner, 2007; Yin, 1994).

Due to this specifics of multiple case studies, there is often a huge chasm between initial data and conclusion. Especially due to the vast amount of data collected in a case study (Eisenhardt, 1989a). Miles and Huberman (1984, p.16) addressed that difficulty: "one cannot ordinarily follow how a researcher get from 3600 pages of field notes to the final conclusion, sprinkled with vivid quotes they may be."

5.2.3.3 Cross-case analysis

As already mentioned above, the last and necessary step for case comparison is the cross-case analysis. Again, a certain frame of analysis need to be stick to as especially in the early days of qualitative analysis the cross-case analysis was under critique as being 'even less well formulated than within-site analysis' (Miles, 1979, p.599). The main problem was identified as being the tension between case uniqueness of a single case and the generalisability for theory sampling (Miles, 1979; Yin, 1981). Indeed, multiple case studies cannot provide a long narrative of specific explanations (Yin, 1981) but need to balance data richness with generalisability (Eisenhardt and Graebner, 2007). This critical approach to multiple case study can be met by introducing a clear conceptual research framework of what is aimed to be studied (Yin, 1981). The conceptual research framework of this

study has been discussed in chapter three and four. Multiple cases can only be compared when similar data sets are analysed, therefore the same coding categories and the same coding steps were used in both case, sticking to the conceptual research framework of this thesis. This ensures the possibility to find out if findings occur in both cases (Saunders, Lewis and Thornhill, 2012; Bryman, Stephens and Campo, 1996) by developing cross patterns. Cross patterns are generalised meta patterns (Miles and Huberman, 1994). Here, it is important to take into account that researchers are often poor in systematically processing information. Cross-case patterns are often influenced by their first impression. In order to avoid that bias it is important to look at the data from many different angles. One possibility is to select dimensions that are important across the cases. They could be on a meta level, being abstract, overlapping all categories (Eisenhardt, 1989a). This was done in a third level coding step again displayed in **Figure 5.8**. During that coding procedure the meta level codes of characteristics and actions of Keystone on different levels of investigations were developed and also helped to redefine the research questions (Eisenhardt, 1989a). This was done by looking for characteristics and actions that were displayed in both cases and in all categories of coding. These cross-case patterns were then ordered and the main statements for every cross pattern category were allocated to be displayed in the findings chapter. The findings for every cross-case pattern category were then validated by re-assuring their main propositions by comparing them with the statements of the first level coding on case study level. “The process of building theory from case study research is a strikingly iterative one. While an investigator may focus on one part of the process at a time, the process itself involves constant iteration backwards and forward between steps. For example, an investigator may move from cross-case comparison, back to redefinition of the research question (Eisenhardt, 1989a, p.546).”

A second tactic, also suggested by Eisenhardt (1989) was used to understand the subtle differences and similarities of each case. These cannot be displayed on a meta-analysis, but need a closer inspection. Therefore, the coding categories that related to the research context, aiming at explaining the environment the Keystone act in and develops his characteristics and actions in, were analysed

for similarities and differences (Eisenhardt, 1989a). This also supported the understanding of differences of Keystones actions and characteristics that ground in this contextual differences. Consequently, cross-case analysis and case comparison took place on all levels of abstracting. Due to this technique new categories can evolve, that were not anticipated before. Another tactic is suggested by Eisenhardt (1989a) as being the division of data by data source. As the case studies displayed here contain a high number of different documents and sources this tactic was not used.

Within case analysis and cross-case analysis contributes to theory development by the identified patterns within cases and across cases. These patterns are linked to existing theory and are shaped by logical arguments (Eisenhardt and Graebner, 2007). While single case studies are shaped by great detail and storytelling, they result in more complicated theories due to the recognition all particularities. Cross-case analysis can detect less phenomena but presents a higher data sickness and is more robust. Multiple case study analysis requires a balance between degree of detail and replication logic. “If the researcher relates the narrative of each case, then the theory is lost and the text balloons. So the challenge in multiple-case research is to stay within spatial constraints while also conveying both the emergent theory that is the research objective and the rich empirical evidence that supports the theory (Eisenhardt and Graebner, 2007, p.29).” Both authors suggest that the best way to address these particularities is to develop theory in sections of meanings which are shaped by the theoretical framework (Eisenhardt and Graebner, 2007; Miles and Huberman, 1994).

As this research is shaped by two cases, the balance between case richness and data richness is essential for developing rich and generalizable patterns to contribute to theory (Eisenhardt, 1989a). Especially, as cross-case analysis is used to look beyond first impressions the closeness to data and its generalisability at the same time a main challenge.

Summarising the above, the complex process of data processing and analysis of the multiple case study is shown in **Figure 5.8**. Different levels of coding took place and provided different levels of abstraction that enabled an in-depth analysis of the single cases. This also allowed a cross-case pattern analysis that balanced between comparability and data richness. In order to understand the

particularities of every case the next chapter introduces every case as well as the context they are shaped by.

5.3 Summary

This chapter presents an overview about data collection as well as data processing as the basis for analysis. Subsequently, the analysis and interpretation of the data is undertaken in the next chapter. The research strategy was introduced and followed in order to enable the analysis of a comprehensive data set and contribute to the understanding of the Keystone role, its strategy and KS activities and its environment. Main findings that contributes to the understanding of **Case I** and **Case II** are outlined in a case study narrative in the next chapter.

6. Case study

6.1 Introduction

In this chapter, both case studies are displayed as a case study narrative (Eisenhardt and Graebner, 2007) to keep a balance between detail and abstraction. Case study narratives can help to provide a single case study analysis by outlining facts and aspects of analysis at the same time for a better understanding. Still, opinions outlined need to be separated from objective narration. Therefore, statements or opinions are clearly marked as such in the text.

Furthermore, the single case study can be taken as a basis for cross-case analysis (Eisenhardt and Graebner, 2007; Eisenhardt, 1989a). In order to enable an overview of both case studies and their specifics, all sources accessed during case study data collection are used. Results from open and semi-structured interviews as well as observation and network mapping serve as a basis for the narrative. Consequently, all case specifics outlined in this chapter are based on primary and secondary data. The references used in this chapter are referring directly to these sources and are anonymised due to ethical requirements stipulated with case study participants. All sources listed were indexed and are displayed in **Appendix E**. Only secondary data is labelled with a date, as primary data was collected in 2016 only.

As discussed in the methodology chapter, it is important that case selection enables theory sampling. Both cases had to provide certain similarities for comparison but also particular differences to improve the validity of cross-case analysis when repetitive patterns of behaviour are found. Therefore, case selection was done by selection of industry and network environment network agents were interacting in. For both cases this meant that networks were investigated shaped by similar, and at the same time distinct, network structures. Similar centralised network structures with a hub firm influencing the network, without knowing what role the hub firm plays. Distinct network structures in terms of being either shaped by more formal or more informal relationships. **Case I** was selected

due to the unstable environment the network is placed in, influenced by disruptive changes already taking place. Additional to that, dynamics in **Case I** are shaped by more formal than informal relations due to a long history of stable and gradual development, which suddenly changed in the recent past. In contrast to that, the **Case II** network operates in a stable industry environment, which is facing future changes. The network itself is shaped by a very informal culture. This means that, network structures in terms of centrality are similar in both cases but they are influenced by distinct industry dynamics. The differences of industry specifics are outlined in more detail in the respective case section.

In this research, the single case narrative also provides the basis for Keystone identification. As already outlined in the literature review, no clear definition exist if company or individual acting on behalf of the company can be identified as a Keystone agent. Investigation showed that both interest, personal and company interest, matter simultaneously. Therefore the term Keystone agent will be used to describe both, the individual and the company level. To avoid misunderstandings, the case study narrative will first introduce the company and its specifics and after that the individual to show how both relate to each other.

6.2 Case study I

6.2.1 Introduction to Case I

As shortly outlined above, **Case I** is influenced by an unstable environment facing disruptive changes. In contrast to **Case II**, a more formal culture of interaction exists in **Case I**, as the industry is shaped by strong competition and a fast changing environment. A more detailed description of **Case I** is provided below. The case selection took place as outlined in chapter five **Figure 5.2**, data collection process.

6.2.2 Industry background

The automotive industry has long been one of the leading industries in Germany (S1, 2017). Shaped by high specialisation and continuous growth a rich industry developed with strong influence on politics (S5, 2017). These structures of specialisation led to the development of supply chains with suppliers located around a central production company, being the hub of a strongly centralised network (R1, 2011). Processes of value creation were strongly adapted to each other and cheap mass production allowed a strong growth. The industry is shaped by big central companies that are built up in a specialised, hierarchical and formal way. They represent bureaucratic organisations (Powell, Kogut and Smith-Doerr, 1996). Suppliers are influenced by a high dependency from the central firm, often specialised on one niche product that features the big company's product (R1, 2011).

Due to the recent global developments of digitalisation and alternative engines (S4, 2017) market mechanisms changed profoundly. The leading market for electro-mobility is China, developments and growth happen mainly in that market. Especially, in terms of progression on autonomous driving. Additionally, manufacturers in France, Japan and America are far ahead to the battery development in Germany (S3, 2017). Norway expanded their infrastructure nationwide to enable battery reload for electricity driven cars (S2, 2017). Experts state that 2016 was considered as the turnaround point for alternative engines (S2, 2017). For the market of autonomous driving Google and Tesla are strong competitors that have not been big on the automotive market before. Additional to all these industry threats of current developments, the German automotive industry weakened itself with the scandal around the syndicate for diesel fumes suppression (S4, 2017). Here, emission values were manipulated amongst suppliers and competitors to avoid compliance with emission limits. Necessary innovations were avoided (S4, 2017). All partners of that cartel collaborated to synchronize technological developments, to influence suppliers and to seal off competitors (S4, 2017). Their agreements were mostly informal and hard to prove. Still, the fact that arrangements existed left a bad reputation. This syndicate enabled the automotive industry to keep to the fuel engine technology for a long time, even though technology evolution was required. Consequently, this delays industry

developments even further (S4, 2017). German political structures were significantly influenced by big industry players and their lobbyists. This led to only scant political influence and no political top down developments pushing innovative technologies (S5, 2017). During that time, informal ties increased industry wide due to close contacts and job mutual job exchange of important responsible persons (S5, 2017). Especially exhaust manipulation was realised by German automotive companies, to strengthen their impact on the US market. Today they have to deal with prosecution in the US which weakens their position even further (S5, 2017). The major threats evolve out of the need of new competencies and capabilities for the German automotive industry (S1, 2017). New competitors enter the market dealing with software, batteries and electric motors.

Additional to technological change, social change takes place in Germany. Exhaust fumes are less accepted in society and growing urban population reflects the existence of too many cars in general (S1, 2017). Many companies in Germany are very late to react to that change (S1, 2017). This leads to the problem, that all big players face the same challenges increasing competition in a highly specialised market. Change often requires new business models but big players are very static in structures and slow in adaption. The bigger the company and the more consolidated company structures are, the worse the starting position for change. Competencies, especially for electric engines, currently need to be bought in. This leads to dependency on suppliers and less know-how building to react to these changes (S1, 2017). Now, companies in the automotive industry are too late to establish on the market and gain pioneer wins. Still, they also do not have to face innovation risks (R1, 2016) as they are in a catch-up-race (S3, 2017). Therefore, they need to adjust production structures to potential new products as soon as possible to have suppliers producing for them, otherwise adjustment of industry will take too long (S3, 2017). The big structural change that is happening to the industry now can be a chance for suppliers. They are often more flexible in new product and business development. Consequently, current changes in industry could be a change for suppliers to get out of big player dependency (C1). Big players in the automotive industry are often called Original Equipment Manufacturer (OEM), a term used here subsequently for big players. Small

and big companies are aware that all companies in the automotive sector need to leave the beaten tracks they are used to, otherwise they will cease to exist (B1). Until now, focal automotive companies have been seen as the economic and technological innovation driver, but digitalisation changes everything (B1). Innovation in big and consolidated companies often evolves from a technology or specialised background and is not necessarily consumer oriented. Disruptive innovation and a completely new technology is needed that is not build on existing know-how (D1). Some supplier state that the automotive industry as it exists now will be vanished in ten years when no innovative ideas develop, there is a tense innovation pressure for the industry (E1). This means that all companies that are currently dependent on big company's developments need to face a complete change, a structural, political and business change in order to meet digitalisation demands (B2).

6.2.3 Regional background

As the automotive industry is characterised by dense supplier networks and by dependency of other companies on the economic strength of the OEM, geographical proximity plays a vital role to ensure frequent interaction for further process and business specialisation. Due to the proximity among companies and the 'economic force field' (Wulf and Butel, 2017) OEMs create, several other regional industries are strongly influenced by automotive industry developments. In times of continuous growth, supply chains reduced business uncertainties (Rong and Shi, 2015) and strong network structures developed. In times shaped by great changes, these structures can lead to slow adaptability within a region (B1). From a BE perspective, OEMs can be described as physical and value Dominators (Zahra and Nambisan, 2012). Due to the strong business network structures innovations are often introduced solely by OEMs. Small companies are highly specialised and do not have necessary resources to invest into new business or product developments (Radziwon and Bogers, 2018). In **Case I**, only one third of SME's and two third of big companies contribute to innovation (R1, 2016) which is due to strong supply chain structures. Regional relations are therefore very centralised and influenced by the OEM, as shown in **Figure 6.1**. The figure displays the OEM in the

centre of economic relationships and is adapted from a study that investigated the regional development the **Case I** network is located in (R1, 2016). **Figure 6.1** shows business relations but no informal structures based on frequent interaction for example. Consequently, the figure provides a first overview of the existing traditional and formal structures in the region. As company names needed to be anonymised, **Figure 6.1** can only give a first superficial insight of the predominant structures of the region, which can be interesting in front of the network mapping results discussed in the finding section. **Figure 6.1** confirms that **Case I** is a centralised network, as sought for, and only a few scattered subnetworks are seen at the edge of the centralised business network structures.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 6.1: OEM in the centre of business relations in Case I

(Source: adapted from R1, 2016)

These business relations influence dependency not only in the region but also within subnetworks that are part of the BE as explained in the network section. Especially this dependency leads to restricted knowledge flows as knowledge intensive firms influenced by business activities with the OEM in the traditional automotive business and are careful with sharing knowledge that supports innovation (R1, 2016). Solely research institutions, with a distinct strategic interest, such as universities and governmental institutions, provide a certain variety in innovation subjects.

Altogether, new ideas developed by new industry participants and a certain actor heterogeneity are rare as the ‘economic force field’ in that region does not allow many new actors to enter and provide diversity (R1, 2016). In order to ensure a healthy development of the region in the future, it is important to develop new value creating economic field that are not related to the automotive sector (S4, 2017). New business developing structures support diversification and new companies can enter the market and reduce the dependency within region due to increasing heterogeneity (F1; R1, 2016). Heterogeneity and less dependency amongst actors can then influence KS without the constant threat of acquisition. This enables the development of innovation in regards to digitalisation. The digitalisation subject is a major change trigger and developments in that area are still underrepresented in the region due to the concentration on the automotive core business (F1; R1, 2016). All companies need to work jointly on the understanding of digitalisation and its impacts. Furthermore, the development of a connecting platform independent from OEM influence is key to ensure interaction among companies. Connecting themes that are cross industry relevant should be developed such as material or security technologies for automotive, defence and the airline industry and energy and health subjects for all industries based in region (R1, 2016).

6.2.4 Network of collaborative relationships

The region is characterised by many institutionalised networks developed due to governmental funds (R1, 2016). Still, this does not lead to an embedded network structure connecting companies between each other. These scattered subnetworks all located in the periphery of the centralised network structures (**Figure 6.1**) cannot help to join forces in order to face big industrial changes, triggered by digitalisation processes (B1). The automotive sector is influenced by a strong connected and centralised network that could enable innovation (Nambisan and Sawhney, 2011) but the network is also shaped by strong interdependencies as described above (R1, 2016). Scattered networks on the periphery cannot influence developments in the centre of the network (NOI-X) even though these

networks are working on technology developments and could enable innovative ideas (Burt, 1992) that are required by the government as they are governmentally funded (R1, 2016).

In order to change these weak regional and industrial structures to react to a possible change, a governmentally led working group developed the idea of an innovation network for the region in 2011. **Figure 6.2** shows the history of this network and also the importance of certain agents influencing network development. In 2011, a first network development idea was introduced and triggered by certain agents that were active in the region. This idea was further developed in a loosely connected network, and was then specified with the application for governmental funds. Here, an institutionalisation of loosely coupled network structures was discussed the first time and agents agreed on certain institutionalisation to increase engagement (NOI-X). Company A, B and D engaged very much in this development, believing in the creation of an innovation platform (B1; D1). 2015 was the turning point for all network agents when the approval for governmental funds arrived. The requirements to get governmental funds for network development were discussed with all agents. The necessity to sign a joint agreement in order to protect any innovation idea developed was one of the reasons why the network started to cease in 2016 (NOI). Another reason were the activities of Company A and B. First, both companies supported the development of the governmental network (B2; NOII) but when they realised that they did not follow the same aims as specified by the government they reduced their support. **Figure 6.2** highlights the change process the network went through, pushed by active companies such as company A, B and D. First, the loosely connected network evolved, subsequently the governmentally funded network named ‘Innovation Network for Virtual Developments (INVD)’ was founded followed by the ‘Association Virtual Development (AVD)’. Latter grew, after company A, B and D realised that the governmentally set aims in the INVD were not supporting their own aims. These incidents were mentioned by distinct sources to be critical incidents in network progression, which were strongly influenced by the interests of company A, B and D. One of the main triggering persons to influence developments was Person B being engaged at Company B. Person B was one of the agents that started to develop alternative network

structures due to the perception that the governmental led network would lead again to a scattered network of specialised technology development, and not to a network that could enable an industry turnaround towards digitalisation (B1). Person B wanted more heterogeneity in the network to develop completely new ideas and the governmental led network meant cooperation between the same companies as in the past (NOI-VIII). That is why Company A and B decided to found an association working on innovation development in region that should steer the development of network structures between companies and provide a platform of interaction. They did so by providing company funds and by developing a privately funded network entity.

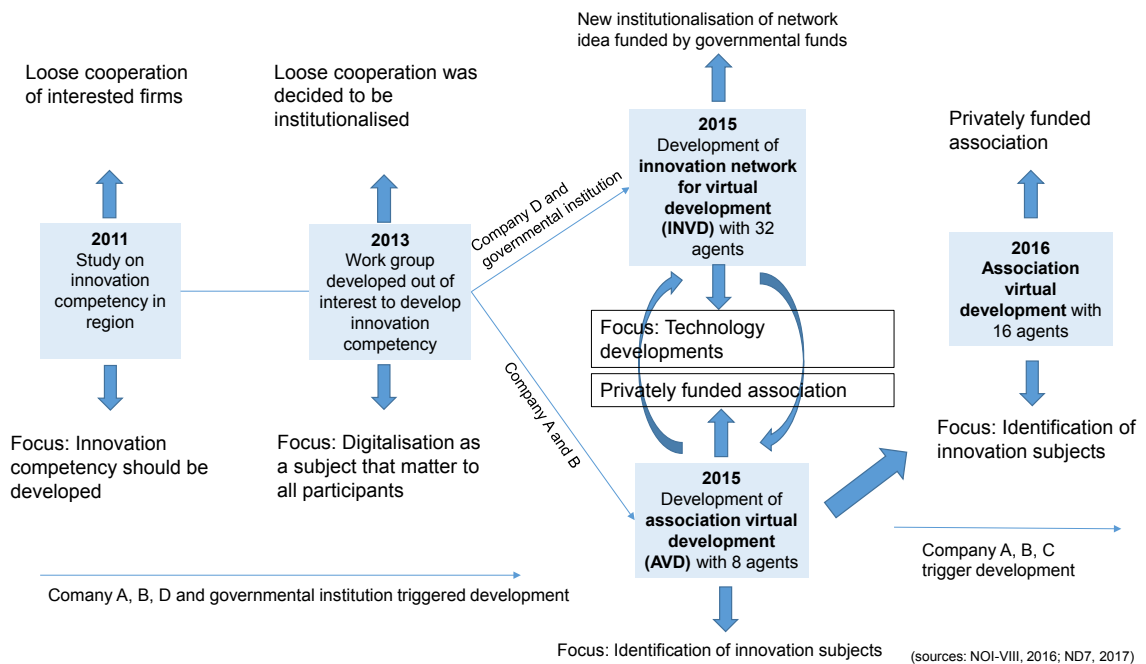


Figure 6.2: Critical incidents in the development of the AVD

Company D, who was very much involved in the development of the INVD, believes that the strong indirect influence of Company A in the AVD hinders innovation development. As Company D is a niche company, providing specialised products, the involvement of the government meant a certain neutrality and protection of his ideas (D1). Especially as governmental support required formal regulations for intellectual property rights (D1). To join the AVD is no option for Company D as no protection of a neutral agent would be available. A neutral agent is an agent with no strong strategic

interest such as a governmental network management from the perspective of Company D (D1; D2). Consequently, Person D/ Company D is not involved in recent network developments any more. Furthermore, Person D lost trust in Person B, the person he was closely cooperating with in the past. This happened mainly due to job rotation of Person B from the regional governmental institution to Company B (D2).

Many companies that were part of the INVD did not join the AVD, but are still closely connected with all agents that were part of the first working group on innovation and digitalisation. The investigation of **Case I** started at the point when the INVD started to cease and the AVD developed strength. Therefore, observations and interviews were conducted in both network entities and were then jointly analysed. The AVD naturally was investigated in more depth, first because the main triggering agents were engaging in that network entity and second because the INVD did not continue with frequent meetings. When network structures are described in this research for **Case I**, they are mainly focusing on the AVD. As Company A and B showed the highest activity in all meetings attended (NOI-VIII), were mentioned frequently by all agents, and influenced network structures throughout the years, they will be investigated further below. Additionally, the AVD's network aim and vision is outlined for further network understanding.

6.2.5 Network aim and vision

The early INVD was funded in order to ensure innovation in different subject areas such as virtuality and digitalisation. The network aim was developed consciously in an area in which automotive subjects were not the focus (R1, 2016; B1). This process was mainly influenced by the companies B, C and D. To enable a cross industry impact, the AVD was founded with a broader aim orientation and vision than the INVD (B1). As the INVD was funded by governmental support and governmental requirements, influenced strongly the development of the network, dynamics between the agents following different aims and visions led to a separation of agent interests and the foundation of the AVD. The AVD wanted to address a broader innovation subject and needed to ensure a certain agent

heterogeneity, in order to enable access to idiosyncratic resources (Barney, 1991). Consequently, important agents of different industries within and outside the region were and are still continuously addressed to engage in the AVD (ND1, 2016). The network aim lies in triggering virtual developments for the region outside the automotive sector (ND1, 2016). From an agent perspective, it is problematic that the automotive industry still attracts many agents by the economic strength (B1; B2; D1). This increases economic dependencies (Power et al., 1996; Brass et al., 2004). Consequently, network agents engaging in the AVD need to be selected carefully (B1) steering network or platform access (Isckia, 2009). This creates a paradox of openness to ensure heterogeneity and closeness to enable specific aim orientation at the same time (NOVII). To follow the network aim, subject followed are related to non-automotive areas (B1). Content or subjects discussed can be brought in by selection of suitable network agents and the development of working groups (NOII). Another network aim is to develop a platform of interaction (ND1, 2016) for new business connections in the region, in order to trigger a heterogeneous innovation network and create innovation potential related to virtuality (ND5, 2015). For an individual agent, the platform can be a source of information where developments head to (C1). This can attract new agents to contribute (NOVII). Diversification is necessary for innovation, still, due to the current regional focus on the automotive sector, no diversification seems to be possible from agent's perspective (B1). Another AVD network aim is to influence governmental institutions to trigger non-automotive developments and enhance value creation. Digitalisation will have a strong influence in the future, politics and government will have to change their support towards providing resources for companies that would like to meet that change. Network aims of the AVD are strongly determined by Company B and C. For example by being a lobbying network as well (B1). Especially for Person B/ Company B and Person C/ Company C the AVD represents an opportunity to create a network that has a certain influence in the region. This enables them to influence regional developments related to digitalisation. Furthermore, they are able to build up network relations outside the AVD to enable the influence of BE development by following their own and the network vision (NOI-X; B1; B; C1). Additional to

that, for Company B and C, heterogenic idea development enables them to diversify their own business ideas. Also, Person B and Person C can live their visionary nature. Person B sees virtuality as losing borders of time and space. This challenge can only be met by heterogeneous agents in networks that share resources and create new value. The region should be able to create those values and provide added value for citizens as well (B1). Still, every company in network also follows its own economic aim. For the success of the network it is essential to consider network aims of other agents and their motives for participating in network (B1). Due to the impact of Person B/ Company B and Person C/ Company C to network aim and vision, they will be analysed in more detail below.

6.2.6 Trust, informal and formal network structures

Due to the above-described situation of high economic dependency in industry and region, one central factor can be identified that influences the development of network structures in **Case I**. The development of trusted relationships among agents is very hard (B1; F1; NOI). No one in the AVD is used to collaborate especially as network agents are mainly competitors, hardly any relational capital can be developed (Pulles and Schiele, 2013). Only cooperation and competition are well known. Everyone in the region is afraid to share ideas openly as they might be communicated to the dominating company and the thread of idea or business acquisition is present (F1). There is no protected room to create innovative ideas (D1). Already without a high agent heterogeneity many ideas exist how innovation could take place. Still, no one wants to share these idea, resulting in knowledge hold backs (Levy, 2011). Although, innovation could attract investors and enable value creation. Ideas are either not shared or not followed further as no one wants to risk to lose them to the Dominator. Still, most of the companies in the network are dependent on Dominator resources to further develop innovations towards new products and towards market readiness. In contrast, AVD founders argue that the AVD is there to help to build up trust by mutual and frequent interaction among agents (B1; C1). Still, they are also aware that due to many distinct strategic interests, trust building is convoluted (B2; C1; ND1, 2016). Company D, the Niche player, states that the lack of

trust is the main reason why his company does not participate in the AVD. The high and indirect influence of Company A and lack of neutrality due to missing governmental support is a major threat for evolving innovative ideas. From his point of view, the importance of Company B and C for decision making and relationship formation in the AVD is restricting the evolution of trust (D1).

The governmental institution believes in the development of network structures triggered by the AVD, but also questions the involvement of Company A and its interest. In their view, a culture of collaboration cannot be developed when companies currently dominating the development of the region have a high influence (F1). All companies that are steering the development of the AVD are at least for about 80% dependent from the dominating company in regards to their business (F1; F2; R1, 2016). When these interdependencies are known, it is hard for companies with a smaller market impact to build up trust (F1). This also means that all agents of the AVD are competitors as long as there are no heterogeneous relations to other regional companies not engaged in the automotive industry (B1), enabling them to build up a competitive advantage (McEvily and Zaheer, 1999).

Still, Company B and Company C try to enhance trust by creating informal meeting surroundings and informal dinners. They try to enhance interaction by pushing frequent interaction and subjects that are interesting to all network agents (NOI-VIII; B2).

Even though, there are attempts to increase informalities and trust, the network entity is shaped by formal relations. Formality starts with the institutionalisation of the network being an association. This also means that there is a board of directors that steers the development of the association. The board consists of Person B/Company B, Person C/ Company C and a consulting company. The consulting company has no strategic interest that relates to the network aim, but closely collaborates with Company B and C and can therefore not offer neutrality to other agents (NOI-X).

Company A did not enter the board on purpose to not create mistrust amongst agents due to its influence in the region (B2). Still, everyone who was engaged in network structures for a certain time knows that there is a strong interaction between Company B and A. In contrast to that, Company B ensures that no one of the board has a traditional business relation with Company A due to their

position within their companies (B1). Nevertheless, Person A and B are well connected because of their joint personal interest in digitalisation and due to their mutual past (NOI-VIII; B2; F1). Additionally, the board confirms that there is a strong exchange between them and Company A. This is to keep track with developments in digitalisation at the OEM and to use business contacts provided by Person A. Person A is well known for being beneficially connected inside and outside his company (B1; C1).

In the AVD, clear structures influenced by certain formal requirements are promoted in order to enable all agents to interact with each other and exchange ideas and knowledge (ND2, 2016). Meetings, being the platform of interaction, are determined in their design by the board of directors. This means that different levels of interaction, as being distinct meetings, on project and network level, are suggested and organised mainly by Company B and C. The same applies for subject areas discussed through that platforms (ND4, 2016). As the industry and the region are shaped by formal structures, all agents are used to that formality and do not know how to engage in a more informal way (B1; C1). Nearly every company business in the region is influenced by the Dominator as cooperation partner, other business contacts that could enable a variety of other cooperation are not appreciated (B1; C1). This dependencies undermine collaboration (Rowley, Behrens and Krackhardt, 2000). Additionally, network agents are not used to share resources in less formal network structures. The association board wants formal cooperation established by contracts in defined project groups, in order to create room specialised KS (B1; NOI-VIII).

In order to support specialised KS and knowledge protection, network participation is restricted. Company B and C regulate the access to the network. The board also claims that a certain closeness is important to protect network agents and their knowledge shared in project groups. In order to develop trust and exchange ideas, everyone needs to know each other. The board is convinced that this development needs time and that closed network structures are important at the beginning (B1). Additionally, to attract heterogeneous agents for future developments regular open events take place to open up information flows to the outside. Every company interested can attend these events and

get information about what the AVD does (ND3, 2016) and how the region's future could be influenced (AD5, 2015) by AVD activities. Still, access to the network is limited as the board decides who can take part at regular network meetings (NOI-X).

The access to the AVD, as being a platform of interaction, is subject to constant discussions between network agents (NOI-VIII). On the one hand they want to protect the knowledge shared, for example in project groups, on the other hand they want heterogeneity of participants and new business contacts. They suggest to create a more open network level of interaction and closed project groups but the board argues with the protection of contacts and content against that agent ideas (NOI-VIII). They are suggesting to develop KS routines to better share KS (Dyer and Nobeoka, 2000).

Network agents chose Person B to be the one who connects with companies and other interested parties outside the network as he is known to be good in addressing others (B2; NOI-X). Nevertheless, this central networking task of Person B also produced many hours of discussions as Person B restricted other network agents to use the contacts he builds up for the network, controlling access to resources (Granovetter, 1992; Gulati, Lavie and Madhavan, 2011). The other network agents could not understand why one person should be eligible to use the contacts all network agents could need (NOI-VIII). Companies B and C argue that due to the reputation of the AVD being the triggering platform for regional innovation development in digitalisation, and the board being responsible for this development, contact should not be misused (NOI-VIII). Especially, when important political contacts are at stake they need to be managed carefully (NOI-VIII). Furthermore, the board argues that it is responsible for network management and innovation structure development in the region and invests a lot of company and personal resources. Consequently, contacts need to be managed by the board (NOI-X). Meaning that a higher responsibility should ensure a higher outcome for the ones taking the responsibility (NOI-VIII). Additionally, contacts enable the board to bring in the right agents that could enable the network to weaken the competition around the Dominator. New competitors can enter the network as long as they are not starting to compete for Dominator business, but this needs to be controlled in order to ensure the right topics for network and project level. As

there is no cluster- or network manager that could ensure these dynamics, the board needs to be responsible for it (B1; NOI-X). Companies in network and group structures need to be well-connected among each other to ensure the development of new subjects. This could also be enhanced by an official network management that is supported by all agents (B1).

To ensure a certain neutrality and to enhance an open network culture of exchange, a network management providing more neutrality is suggested by the regional governance entity and Company D (F1; D1; C1). Less solitary economic interests in the network can enable cooperation by following collective goals (Brass et al., 2004). Still, the aim set of such network would again be influenced by governmental requirements, which are still focused on technology innovation in the region (F1; D1; C1). Whereas the aim of the network board is to build up regional network structures for innovation (B1).

Figure 6.2 underlines that a network core exists that influences structural developments on network and industry level (C1; NOI-VIII). This core builds an influential group of collective social capital (Lin, 2017). The participants of that network core changed slightly when network structures changed from governmentally influenced structures to the privately funded network. Still, a network core of three central players remained being Company A, the Dominator of economic development, Company B and Company C. The network core evolved around a same interest, same opinions, enthusiasm, vision and personal engagement (A1; B1). No matter what network meetings were observed, always the same people influenced interaction as well as further developments (NOI-VIII; F1). Tasks in this network core are distributed, one is organiser (consulting agency), one is communicator (Person C) and one is the politician and contact maker (Person B). Person A is a salient network core member. They rely on each other as they know that they have the same vision and engagement (NOI-VIII; C1). Summarising the above, Company B and C are not only part of the network board but also of the network core influencing network development, relationship building, KS and network access.

6.2.7 Knowledge sharing and strategic interest

Strategically relevant knowledge is very important to all agents and a main motive to be active in the AVD (NOI-VIII), corresponding to literature (Grant, 1996a). As outlined in the industry section above, great changes are about to come that will impact the industry, the Dominator and therefore the region substantially. Therefore, every company needs to secure its own business due to the high dependence from the dominating company. First cut backs already arrived at the supplier companies and employment development stagnated (B4) which has a direct influence on economic development in the region (R1, 2016).

The AVD network structure, developed by the board of directors, should ensure the optimum sharing of knowledge (NOI-VIII). The exchange of specific knowledge about determined subjects is supposed to happen in project groups and the exchange of general knowledge on network level (ND4, 2016; ND6, 2016). This should enable all agents to work on other subjects than solely mobility, as all project group subjects relate to the subjects of digitalisation or virtuality (ND4, 2016; ND5, 2015). Especially on network level a broader knowledge about industry and technology development should be developed as on network level all AVD agents are connected (B1), enabling a broader knowledge space (Sawhney and Nambisan, 2007).

Together with the existent expertise of all network agents, this should enable the AVD to develop innovative subjects, attract investors and reduce dependency from the automotive sector (ND2, 2016). The possibility to share subject specific or business knowledge is influenced by meetings conducted and their participants. The AVD board, being mainly influenced by Company B and C and indirectly by Company A, determines who takes part at the meetings. They argue that the knowledge base of the companies participating need to fit together (NOI-X).

Meetings can be administered easily due to company's geographical proximity (Inkpen and Tsang, 2005; McEvily and Zaheer, 1999). Proximity of network partners is positive on the one hand, because everyone is aware of the dependency on developments and everyone can be addressed more easily and personally (C1). On the other hand, proximity among partners makes it even harder to cooperate

due to the strong competition in the region (D1). Especially, when the region is characterised by specialised SMEs. They live from their ideas and need to protect their unique selling propositions (D1). In order to enhance cross-industry KS and the development of trend-setting ideas, the board also addresses companies of the construction industry and of medical and political institutions (C1). New network agents can access the network when they meet certain requirements. The aim of the board is to reach a good mixture of mid-size and big companies with a collaborative culture and enough resources to engage. This way they want to enable the sharing varied knowledge (C1) supporting new knowledge combinations (Shafique, 2013). To enhance KS, a certain network strategy of network agents is useful, as they show enough interest (NOI-X). Still, a strong strategic interest could increase competition and hinder interaction (B2). Some agents want to screen the market, some want to develop new products (NOI-X). The strategic interest depends mainly on the company's dependency from the dominating company (Iansiti and Levien, 2004a; Madhavan, Gnyawali and He, 2004). Many companies in network are observed to not have a strategy or a vision (NOIX). They are part of network as they want to gain projects in and observe where the Dominator goes (NOX). The smaller the company the higher the dependency and specialisation the smaller the individual strategic interest (NOI-X) There is a critical mass in terms of company size to get out of that total dependency and invest resources for other innovative developments (C1; R1, 2016; B2). Therefore, some small companies, such as Company C try to diversify its business and reduce dependency (C1). Often, SMEs have only restricted financial and human resources, and cannot continuously conduct research and promote innovation (R1, 2016). Although, small companies cannot invest as much resources they are often represented by their heads and therefore can show bigger interest than representatives of big companies. In order that a representative acts in his company favour personal and company interest need to overlap strongly (F1). All companies, no matter what size, are often interested in a measurable outcome of their resource invest, such as a technology or innovation development project (F1). The possibility to connect to Dominator and get business seems to be present all the time (C1; NOI).

Even though agents need to align their vision and aims to what their company can reach and what the network could offer (Madhavan, Gnyawali and He, 2004), in order to successfully cooperate and collaborate, the network board is not sure about the motives of other agents for participating in the network and if company aims are aligned at all (B2; C1). They are aware that, for enhancing trust and network cohesion, all motives for cooperation need to be considered (C1). Nevertheless, network agents call for greater openness, heterogeneity and neutrality of network management in order to create trust and improve KS (D1; NOI-VIII).

6.2.8 Keystone identification

Considering characteristics and actions related to the Keystones outlined in the literature chapter, the Keystone could be identified by relating the main characteristics as displayed in **Figure 6.3** to the companies and individuals active in **Case I**. **Figure 6.3** shows that network agents were implicitly asked in network interviews for companies fulfilling the characteristics listed, network observation was analysed for Keystone identification and certain network mapping questions can be related back to Keystone identification. Results show that Person B/Company B and Person C/Company C are directly related to the characteristics.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 6.3: Keystone identification by main Keystone characteristics Case I

(Source: adapted from Keystone description of Iansiti and Levien (2004a))

Network mapping used distinct questions for Keystone identification, as outlined in **Figure 6.3**. The specifics of network mapping are explained in the methodology section and the detailed results in the finding section. Here, only network mapping results are mentioned, that support Keystone identification. First, agents were asked who is considered to be the trigger of the network. **Table 6.1** displays that Company B mentioned most often being stated to be the trigger by 50 % of the agents. Not surprisingly, Company A received a high number of answers. Taking into consideration that Company A was always involved into network development and Person C is still personally bonded with Person B, the perception of network agents is that Company A is still very much involved into network evolvement. This also explains why Company D is listed as well, being a former important part for network growth in the region.

Company Name	Number of respondents	Percentage
Company B	5	50%
Company A	3	30%
Company C	1	10%
Company D	1	10%
Answers: 10 out of 16 network agents (13 network agents returned the network mapping sheets but only 10 agents mentioned a triggering person)		

Table 6.1: Case I: Respondents on identifying the triggering network agent

Taking into account that Company A is, defined by its main characteristic of value extraction, a Dominator company (Iansiti and Levien, 2004a), it is not further considered as a Keystone company. Person A/ Company A specifics are outlined further below as the influence of the dominating company it is strongly interwoven with Person B/ Company B. Relating to this, the question arises if Person B/Company B is only a proxy, or in other words a representative, to Person As/ Company As interests. Network observation and agent interviews showed that the interests of Person B/ Company B were overlapping, still, the main motive for engaging in the AVD network and for engaging in regional development is the necessity to create a higher independency from Company A business (NOI-VIII; B1; B2). Consequently, as a proxy, the current interdependency would even strengthen (B1; B2). Nevertheless, 50% of agents naming Person B/Company B as being the trigger and only 10% naming Person C/Company C as trigger. This is not a strong result, even though both companies showed a high influence in network history as shown in **Figure 6.2**. Therefore, other questions asked in the network matrix were used to identify the Keystone. **Figure 6.4** shows how the questions asked can be related back to Keystone characteristics displayed in **Figure 6.3**. Referring to this questions, and as displayed in the network matrix result table in the findings chapter of this thesis, Person B/Company B and Person C/Company C received the highest scores for all three questions among all members. This result underlines B and C to be Keystones.

Category asked for in network mapping	Characteristic related to
Relation is mainly build on many meetings and conversations we had	Ask network members if Keystone distributes information to enable value creation
We have very often contact	Show if Keystone is in central when it comes to non-economic relationships
I often receive information or help if I ask for it	Ask network member who engages with them

Figure 6.4: Keystone identification through network matrix

Additional to the tables above, **Figure 6.5** displays a network map to show the importance of Company B and C, additionally to A. Company A dominates business relations whereas Company B and C are in the centre of interaction. The figure shows business relations asked for (in blue) and relations based on interaction (in pink). Answers relating to these relations are derived from the network matrix in the findings chapter and are explained there in more detail. The graph resolves that the Keystone companies occupy central positions related to interaction, rather than to business relations. Being a hub firm of informal relations (Hurmelinna-Laukkanen and Nätti, 2017). Especially, in front of **Figure 6.1** above, the result displayed here proofs that Company A is in a central position when asked for business relation but not when interaction is asked for. Network mapping results together with network agent statements and observation results as outlined in **Figure 6.3**, Company B and C can be identified as being Keystones. Therefore, not only one but two Keystone companies can be defined, that fulfil central tasks within the network. In the following, the key players of **Case I** will be described in more detail. They are also the companies that are referred to as being the network core (NOIX; F1; F2; F3).

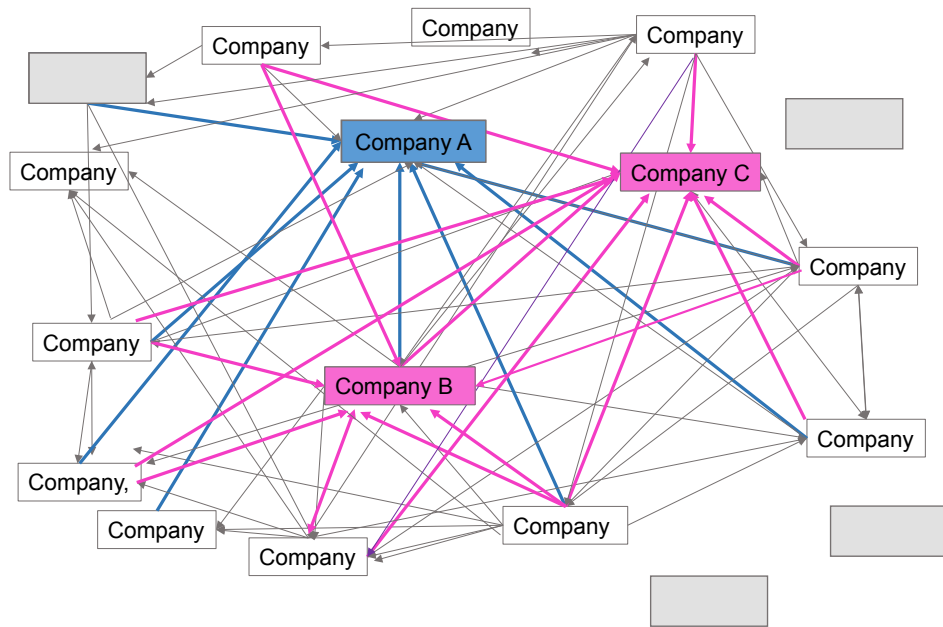


Figure 6.5: Network structure resulted from network mapping

6.2.9 Company A

As outlined above, Company A plays a vital role in network development throughout the history of **Case I (Figure 6.1)**. Due to the company's relevance on economic developments (R1, 2016) and its influence on other key players in the region, the company and the employee who is acting on the company's behalf are introduced below. It is very important to outline both, the company's and the individual's characteristics in order to understand the role of the network agent. The interplay between individual and company are of particular importance as individuals acting for their companies in networks and their level of engagement directly influences the company (Grant, 1996b). Interviewees stated for example, that it is essential to have overlapping company and individual interests to have an engaged person in the network (B1; B3; C1; F1). Still, economic influence of the company also affects the influence of the individual (Rong et al., 2010) and its actions (Jarzabkowski and Spee, 2009).

Current industry developments force Company A to react to new developments such as new business areas globally spread around digitalisation and electric engines and new competitors that are themselves global players of their market (S1, 2014). The company now faces situation of uncertainty,

which requires a start where no one knows how to start (NOVII). In the annual report 2016 Company A states that the automotive industry is experiencing the biggest change in its history, a challenge that needs to be faced in an agile and flexible way (AD2, 2016).

6.2.9.1 Company characteristics

Continuous growth influenced the automotive industry for a long time and bureaucratic company structures could evolve, enhancing bureaucratic processes (Grant, 1996b). Company A is a highly consolidated, public limited company that could specialise to all areas of auto mobility in the past (AD2, 2016). More than 50.000 employees work for Company A in highly specialised areas. The company already considers reorganisation of strategy processes as being important, as well as restructuring of company structures. Restructuring inflexible structures towards more flexibility is considered to support meeting digitalisation and KM challenges and reacting to these radical changes (AD3, 2014). Still, Company A suppliers are already facing the cut downs of the company (B4) and the annual report 2016 shows only a marginal profit (AD2, 2016). The company contains strong and specialised business relations regionally and globally (AD2, 2016) but needs to rely on the regional network when it comes down to innovation implementation, as all production expertise resides within the supply chain network (A1). Supply chain structures help to produce their product to a certain price and enable a high margin for Company A (AD2, 2016). From that viewpoint, these structures were useful for a long time. Now the predominant formal as well as strongly specialised structures in the region start to be a problem, as homogeneous structures hinder innovative ideas to develop and closed network structures circumvent heterogeneity (A1) hindering the CR to foster (Fox, 2013). Company A is itself shaped by strong formal structures with highly specialised employees that are embedded in a set hierarchical system (AD7, 2014). Industry development is now exponential. The company board realised that many existing areas within the company need to be connected to react to industry development (NOVII).

6.2.9.2 Company vision and aim

As the section related to KS and strategic interest outlined, the company vision and aim contribute to the willingness and need to collaborate (Gulati, Nohria and Zaheer, 2000). Therefore, Company A vision and aim are discussed in this section. The current company vision is stated to be realised until 2025. Under consideration that a great transformation of structures and products has just started, changed customer behaviour, new markets and new competitors will be identified, recognised and reacted to (AD2, 2016). An agile business structure will be developed as well as a new BE around digitalisation that includes all relevant actors of the region (AD2, 2016). Automotive and mobility remains at the centre of developments but cities and citizens are seen as the most influencing aspects for this progress. In sum, all current projects and actions will help to reach that aims and visions (NOVII). Summarising this, Company A wants to maintain its product portfolio and mainly works on restructuring expertise within the company. Diversification is not aimed at, rather a use of existing expertise to reach new mobility aims, concentrating on customer needs. Person A sees this developments with scepticism, as new expertise and new partners, such as cross-industry partner, are needed to enable not only gradual but disruptive innovation (A1; NOVII).

6.2.9.3 Company strategy and business model

Corporate developments in recent years were fostered towards digital topics but only as a side-line to traditional markets (AD1, 2016). Market penetration with highly specialised products was the main strategy as traditional markets showed only a very slight decline (AD 1, 2016). In the middle of the year 2016, the new corporate strategy was presented alongside the above stated vision. The strategy is shaped by visions and aims around the three main concepts of digitalisation, urbanization and sustainability (NOVII; B2). Digital change will be supported by company restructuring (NOVII; B2), knowledge will be gained around autonomous driving and turning big data into intelligent data. Company A is interested in connection of mobility and regional development as well as electro mobility (AD2, 2016; AD4, 2016). The strategy can only be followed when suppliers and other

network partners also commit to the change and adapt to the new specialisation of Company A (NOVII). Company A wants to create its own BE shaped by thematic and geographical proximity to enable change and implementation of innovative ideas including not only suppliers but all actors relevant to succeed with transformation and change (NOVII; A1). Global partners are mainly there to test ideas as idea development and implementation is only possible with suppliers and within region due to the mutual expertise (NOVII; A1; AD6, 2013). Network partners of Company A state that a completely new business model is required to enable interaction among all actors necessary for change. In the age of digitalisation technology will not be developed by only one company anymore and network structures are essential to keep up with innovations (AD6, 2013). Technology as such can and need to be shared otherwise digitalisation does not work. As Company A disposes of enough resources the implementation of innovation can be the new unique selling proposition (D1; B1; C1).

6.2.9.4 Company A- Person A

Person A engages for Company A in regional and global network structures (B1; A1). He is a long-standing employee in a leading position but does not belong to the company head. Due to his position he can give great insights into company developments and he is connected well with nearly all company units (AD7, 2014). He maintains a strong informal network inside his company (Stacey, 1995). One of his key tasks is the restructuring of the company and the redevelopment of processes in order to reach the new company vision and fulfil the strategy of transformation (NOVII). Due to his connections internally and externally he is a contact provider for several parties (B1). In addition, he is not only part of the perceived network core group, he is also responsible for its formation (D1). He is technically skilled but also involved into strategic considerations of Company A. His connections reach to the board of directors (A1). From an expertise point of view he can provide know-how insight as well as strategical knowledge (B1). Person A is connected to nearly all network agents due to business relations of Company A (**Figure 6.1**) and he is a key driver of change in his company (AD3, 2014).

He identifies himself very much with company aims, vision and strategy and he likes to engage personally in all these subjects by aligning his personal interest with company interests (Bosse and Phillips, 2016). In order to reach his aims, he uses informal structures of communication as he knows that hierarchies can hinder certain developments (A1; NOI-VIII). Informal connections are important to him and he would like to enhance informal ways of behaviour and interaction among network agents as well, but he is aware that his position in the network hinders others to connect personally (A1; B2; NOI-VIII). Person A is convinced that developing a digitalisation ecosystem lead by Company A could help to reach the company strategy (NOVII). This BE needs to include heterogonous actors, such as the city and other technological players that are no competitors to enable cross-industry KS (NOVII).

6.2.10 Company B

Even though world trade develops positively, Company B is in-depth. The current company focus on automotive industry directly reflects the crisis (B1; BD4, 2016). 2016 did not provide enough orders for the company due to financial situation in automotive sector (BD1, 2016). Additionally, the company develops new technologies and products and needs to focus on research and development. The lack of investment funds to finance research is a situation the company needs to react to (BD2, 2016). Company restructuring already started (B1) and internal processes get slow also due to changes at the OEM and other suppliers (B1). The new fiscal year 2017 can hardly be predicted because of the development of the automotive industry (BD4, 2016). This creates a high uncertainty for the company, which has not been as strong with minor dependencies on Company A or other dominating companies (BD4, 2016). As long as the situation remains reasonably stable, further research and development and new technologies will be driven forward as well as investments will continue (BD1, 2016).

6.2.10.1 Company characteristics

Company B is a service supplier focusing on innovative developments mainly in the mobility sector. Mobility also means air and rail mobility. More than 50 years of expertise helped the company to develop from a small SME to a public limited company with more than 500 employees (BD2, 2016; BD3, 2016). The company structure is shaped by a holding company and several decentralised subsidiaries that are spread across Germany and located near to their core customers (BD2, 2016). All subsidiaries are led by their own management and act as profit centers (BD1, 2016).

In order to develop new products and technologies in the mobility sector, complex know-how is needed. Especially autonomous driving is a growing field for the mobility sector (BD1, 2016).

So far, the flexible company structure enabled the company to react quite fast to changes (B1). One of the main reasons to this adaptability is the geographical proximity (Inkpen and Tsang, 2005) to important customers to realise market changes from their beginning on. This way, innovative subjects can be transferred directly to the responsible business unit. A certain employee flexibility and openness is also required to transact this adaptability (BD2, 2016). Employees characterise their company as being a big company offering security but being shaped by SME characteristics (B2; B4; NOII). The company also anticipates responsibility and commitment of its employees to engage on their job position as it is shaped by flexibility as well (B4).

The company culture of Company B is dependent on the business unit. Business units working within traditional businesses in the automotive sector are often not open and collaborative. Person B states that in an environment shaped by customer pressure it is hard to build up a collaborative culture (B1). Also, diversity is reduced due to the need of specialisation and to develop new projects or business themes are not a core task of the employees (B2). These departments will remain as long as money is earned with traditional business (B1; B2; B4). Other business units related to more innovative subjects are creative, open and collaborative. Employees working here are required to develop new business ideas and technologies that are connected to the digitalisation subject. Two middle manager leading one department with two business units are currently affected by digitalisation topics. One business

unit focuses on technology development and one focuses on digital marketing and network management (B1; B2; B4). Company B departments are structured as profit centers. The digitalisation department, both middle managers work at, is currently the only department that operates in black numbers (B4). Their department is directly connected to the company head as they develop innovative themes. Employees engaged in this department report that they are satisfied with the responsibility they can take (NOII). Due to this importance and their personal engagement they like to be appreciated for their work (B1; B2; B4). Still, the main motive to work in the department is good atmosphere and relevance of work to the company and the creativity premised (B4).

6.2.10.2 Company aim and vision

The company vision is to be a shaper of the future by reacting to new developments of the market, adapt to core customer changes but also by introducing new technologies for the new age of digitalisation (B1; B2; B3; BD4, 2016). Diversification of company products is aimed at in different areas of mobility but also in new areas that have not been discovered yet (BD2, 2016). Network structures will help with this task, not only inside but also outside the company (BD3, 2016). Other than Company A, Company B wants to engage in completely new business areas that not have to relate to the mobility sector. The company head see's technology orientation as key, using digital core technologies for different industries (BD1, 2016).

6.2.10.3 Company strategy and business model

Currently, traditional business units and their products start to lose their importance to Company B and the company needs to react to that changes (B1). To get independent from market deviation in the mobility industry, new customers in new industries were started to be addressed in order to increase numbers of use cases for core technologies developed by Company B (B1; BD2, 2016). Regional activities influence the subsidiaries based in the very region. In such homogeneous regions as in **Case I** it is hard to diversify business. Here, a balance need to be kept between dependency and independency from big players (B2). Suppliers can either adapt to big company strategy or go ahead

with new developments notably in times of a crisis (B1; B2). Company B tries to go ahead and to use changes as a chance to be faster in current developments. In order to bundle resources and knowledge to reach that strategic aim, own strength and role need to be found and kept. This is why network engagement is very important for Company B (B2). Especially digitalisation cannot be comprehended by a single company alone (BD2, 2016). A certain openness on network developments is necessary to meet this challenges (B2). Some network agents believe that Person B only engages in networks to get even closer to Company A and follow its strategic interests (De Witt and Meyer, 2010). The activities of Person B have been outlined briefly above. For Company B, virtuality and digitalisation need be further developed in order to be able to diversify. This not possible without engagement of all players in the region. Particularly developments of the new business units are shared freely in the network. This is due to the fact that development in this business unit does not relate to big player key product areas (B1). Employees at Company B feel like they can try more when the dependency is not that strong. They hope that other network agents start to realise that and begin to share ideas as well (B1; B4).

This network commitment goes alongside with the company diversification strategy. Digital marketing and virtual reality are important components of the new business units. Company B already shares information about business unit developments in the network and beyond while hoping to get ideas back. Supporting this, Person B consciously introduces topics to the network as well as beyond the network and within the region and the industry that do not belong to Dominator key product areas (NOI-X).

6.2.10.4 Company B-Person B

Person B is engaging for Company B on network level and is active as one of the board agents of the AVD. He is middle manager in Company B, with a small team of employees and working for a business unit that tries to develop new business areas for the company. He was suggested by the company head to his current position and is directly connected to the company head due to shared

interest in digitalisation (B1). The head of Company B knows Person B from Person B former engagement in the regional government and knows about his contacts in the region. This is why he engaged him to be active in network structures representing the company head (B2).

Person B is personally convinced that someone who does not know his position and role in network structures cannot implement a network strategy and will most probably leave the network at some point (B1). Consequently, strategic positioning in network structures is key to company success in that particular network, but also beyond the network (NOI-VIII). Furthermore, network structures are not just there but need to be build up and moderated (B1). Person B is aware that all structures and relationships in the region are influenced by Dominator business (B1). Furthermore, governmental support based on public money can only be gained through innovative technology development. Person B thinks that no one feels responsible for regional development even though digitalisation will affect the region and all companies in the region to a great extend (NOI-VIII). Person B is aware that currently no force field for innovation and no structures exist that could enhance regional development. In addition, no other agent than himself (Person B) triggers the evolution of digitalisation subjects in the region (B1; B2). There need to be cross industry connections in order to reach digitalisation challenges and a joint vision or aim that brings heterogeneous actors in region to mutually engage (B1; B2). Developments in the region need to go far beyond the AVD network. Person B sees the network as a starting point to influence changes (NOI-VIII). Person B already connects other networks that could work on same subjects with the AVD and tries to influence political contacts to support the development of a more heterogenic region and a platform for innovation in digitalisation.

As already described above, Person B has a leading position in Company B and is directly connected to the company head. He is also well connected to Person A, by his personal interests but additionally due to his former employer, the regional government. Person A and Person B connect on a personal basis due to their cross industry interest, their passion for digitalisation and in order to generate contacts serving interesting new insights. Both like to use informal structures and direct contacts (B2).

The relationship between the head of Company B and Person B is shaped by a direct connection as well, based on frequent interaction, trust and transparency on both sides (B2; B4). It is a reliable relationship enhancing the willingness to share knowledge (Politis, 2003; Gruenfeld et al., 1996).

The head of Company B completely relies on Person B decisions in network (NOI-VIII) and is waiting for strategic directions resulting from Person B activities (B1) contributing to the aimed strategic turn (B4). Company B therefore relies on knowledge from CR to improve strategic decision making (Gulati, Nohria and Zaheer, 2000). Strategic considerations and insights given by Person B are parts of strategy developments (B1; B2). This way he is one source of many others for the company head to take strategic decisions but still important to improve decision making (B2). Especially, when network relations offer insights to how other companies work on the digitalisation challenge (B2). As mentioned above Company B freely shares information about the new business unit and its development with other agents in the network and tries to collaborate on the subject of digitalisation, trying to use mutuality to enhance knowledge sharing (Teece, 1998; Levin et al., 1987; Grant, 1996b). Still, the company would not give away knowledge of traditional business areas (NOI-VIII). Altogether, Company B's strategy in the network is shaped by continuous adaption about what is happening, how it should be treated, how information is processed and how open the company can be to other partners (B2). Person B knows that these considerations and his work directly contribute to Company B's diversification strategy. He also considers himself as being particularly useful due to his diversified personal background and interest into the subject (B1). Still Person B is aware, besides all development towards independency, that the implementation of new ideas can often only take place in cooperation with big players by combining resources (Teece, 2000; Kogut and Zander, 1992). Currently, there is no resource invest into innovation implementation in Company B and new ideas are mainly important for strategic decision making. Employees of the business unit that is working on these creative subjects feel dissatisfied that their ideas do not seem to contribute to know-how development or knowledge integration into product development (B4).

Considerations about personal involvement in network development shows that characteristics related to the agent's personality are key for networks inside and outside the company (B1). Person B describes himself as being a visionary person, a local patriot, a lobbyist, an idealist and a mediator (B1; D1). He is sure that synergies can be created out of every collaboration and that resources always need to be used optimally by matching the individual resource invest of every company and person in the network (NOI-VIII; B1; B2). He has a certain way of connecting with people and getting access to them by addressing their personal interests (NOI-VIII) and willingness to share knowledge (Bosse and Phillips, 2016). He is also able to keep relations for a long time and addresses these relations when they are needed for network development. In addition, he separates important people for the network from people that are not as important and addresses these people directly (NOI-VIII). Many contacts, such as the contact to Person A and C are shaped by frequent interaction, which is kept active by Person B (NOI-VIII; B1). He is personally convinced that cross-industry network structures are necessary for further regional development and he wants the region to prosper as he lives there as well with his family (B1). Consequently, he aligns his interest with company interests (Hwang, Lin and Shin, 2018; Bosse and Phillips, 2016). His engagement is also due to the need to secure his career position (B4) but he mainly follows his own vision to shape the future of the region (B1). As he knows that the future depends on the development of the main player influencing economic development, he is aware that he can only follow his vision in a strong network position. His network vision is that more than 30 experts build a platform of innovative development in region that enables others to connect to that platform and exchange know-how for virtual innovation and build use cases for technology (B1).

6.2.11 Company C

Being the third company identified as part of the network core, Company C is briefly introduced in this section. As the company is not as active as Company B (NOI-X), the emphasis was not on an in-depth investigation but rather a search for the most important characteristics and actions that define

Company C and Person C. The reason was a better accessibility of Person B, a greater activity of Person B in network structures and the higher number of network agent respondents numerating Person B/Company B as triggering agent. Nevertheless, Person C/ Company C was observed to engage very actively in all network meetings, cooperating closely with Person B and A (NOI-X). Company C also followed strong individual strategic interests and still tried to keep the network alive (NOI-VIII). By matching Keystone characteristics as displayed in **Figure 6.3** to Person C/Company C it could be considered acting as a Keystone as well.

Company C is a specialist in his area of software creation, design and digitalisation of industry processes (CD1, 2008; CD6, 2016). Apart from the activity in the AVD, Company C itself is well connected in his niche market and a platform of know-how exchange in his area (B2; CD2, 2017). The company arranges a congress for software creation and design every year and connects international and national companies of the same area with each other. As a SME with 51-200 employees (CD3, 2017), the company is characterised by a familiar company culture where everyone is connected well (NOVII). Flexible structures and open job specifications mean a high personal responsibility for every employee (CD7, 2016; NOVII). Additionally the company is well connected to universities (CD4, 2016), as it cannot invest its own resources to new and innovative developments. This is also one major reason to engage in network relations (C1). Being relatively new in the industry (CD5, 2016) the head of the company hopes for novel contacts and offers in traditional markets and for innovative business ideas. The company also needs direct contacts to company heads of bigger companies, such as a direct contact to Company A to ensure its growth and combine resources (Ahuja, 2000). Large companies could be potential customers or innovation implementers (C1). To increase visibility, Company C currently sets up a partner network and tries to find potential customers to enable firm growth. Specialisation in certain areas and diversification are core parts of the company strategy. This way the company aims to establish its products in different relevant industries (C1). Company C has not many direct relations to big players but is well connected to other niche companies in same area (B1). Therefore, collaboration between Company B and C serves themselves

with a number of new contacts, hence new resource access (Dyer and Singh, 1998). Even though, Company B and C cannot be compared by company structure and size, the same enthusiasm and idealism exists when network relations need to be fostered and developed (B1; C1). Currently, there are no direct benefits from networks, as the technology provided by Company C is often too specific. Still, the company head believes in a contact snowball system offered by networking activities. In order to invest more personal resources, the company head restructured his company so that he could invest more time into network meetings, believing in direct interaction (Powder and St. John, 1996). He also considers the political network that evolves from network engagement as being helpful in the future (C1). To succeed with technology development in front of digitalisation processes there need to be network bridges that connect different players and know-how supporter. The company head states that a certain size is necessary to build economic pressure but no particular size is needed to build up network relations (C1; NOVII). He is also aware that two views, the network and the company view, need to be considered in order to be successful in network structures. From his point of view, both need to be adjusted to each other to be able to make strategic decisions such as the development of new business models (C1).

6.2.11.1 Company C-Person C

Person C engaging for Company C in network is one of the company heads. Being a public limited company the company comprises of a management board with two CEO's. Person C is described as being visionary, personally engaged, being a communicator and a mediator (C1; NO VII; F1; NOI-VIII). Furthermore, he is personally interested in the digital transformation of society as he knows that he will be affected as well. He is convinced if something needs to happen it needs to be done by yourself (C1). Person C believes that personal interest is always the main motivation for network engagement. Due to his visionary character he engages with Company C employees directly to reach interaction and a direct impact of decision making. The other CEO supports the network engagement

of Person C as he believes the company needs to be well connected amongst companies with same vision about digitalisation (NOVI).

6.3 Case study II

6.3.1 Introduction to Case II

Other than in **Case I** a rather stable environment was selected and a network that is shaped by more informal than formal mechanisms. The same method of open interview sessions to select the right case were used as in **Case I**. The emphasis of **Case II** differs slightly from **Case I** as the Keystone firm influence in **Case II** is even higher than in **Case I**. This means that the firm itself and its strategic interest are investigated in greater detail in **Case II**, in order to learn strategic aims followed on network level (De Wit and Meyer, 2010) and to understand strategy-as-practice actions (Jarzabkowski, Balogun and Seidl, 2007). Keystone selection took part as in **Case I**. The display of **Case II** is also based on primary and secondary data.

6.3.2 Industry background

In contrast to **Case I**, **Case II** is situated in a sports industry environment and is influenced by distinct industry influences. First of all, the elite sports industry was continuously growing during the past decades being an industry that offered secured investments and profits (ID3, 2014). Competition is global and until 2013 the industry grew faster than the GDP of many well developed countries. Business models within that industry could be developed without high uncertainties and all industry participants were working on securing market shares and market segments (ID3, 2014). Market participants are Media, Brands, Associations, Unions, Clubs, Athletes, Sport technology companies, Investors, and Sponsors (ID1, 2017). German associations, clubs and Unions are spread all over the country and connected with each other by sport type (IBD6, 2017). In comparison to **Case I**, the industry of **Case II** contains a high number of heterogenic actors.

Even though competition is global, countries develop their own rules for elite sports to ensure equality within country games. Competition rules and ethics should be the same globally but are often not met. Even more so, rules of competition and interaction influence the whole industry (IB1). Technology developments cannot be introduced easily as they need to be tested for being compatible with existing rules for competition (ID5, 1995). Despite a strong culture of competition and formality in order to ensure a fair game, the sports industry is also shaped by a collaborative team culture. In this environment of formal rules and structures informal interaction is needed to reach aims (IB1). Competitive environments have to be formal, participants have to stick to contracts, but when everyone is used to collaborate in teams a certain informality can still develop (AA7), which also affects the culture and structure of networks within that industry (AA7). In contrast to **Case I**, informality and informal behaviour is a cultural aspect that is needed to reach sports and industry aims.

A certain personality of individuals can be met in this industry, being open minded, collaborative and driven by team spirit (AA7). Industry participants are highly specialised in their market niche and dependent on the continuous development of the industry (ID3, 2014). Currently, future changes are already recognised by industry participants but have not yet strongly affected the industry (ID4, 2017). At the present state, a further continuous growth is expected (ID1, 2017). Other than in **Case I**, no disruptive changes take currently place.

Still, due to expected changes influenced by global trends like digitalisation, industry experts think that the continuous growth of the last years will decline by about 20% in the future. Especially, young people are changing their behaviour due to digitalisation and consume different products. Traditional media use is replaced by digital gaming, which influences media income as one main income generator of the industry (ID4, 2017). Virtual reality as a technology is a central innovation that will affect sport broadcasting (ID4, 2017). Industry leaders have to react to future changes soon, especially as big global players enter the market, such as Google, Amazon and Facebook, gain market shares and consolidate advertising turnovers (ID1, 2017). Digitalisation and consequently digital

transformation have reached the sports industry and will change business models in the future. The usage of big and smart data becomes important as well as their relevance to ethical aspects in sports. Experts agree that the sport industry is facing a turning point (ID2, 2017).

Even though changes will affect the elite sports industry intensively first, all mechanisms described will also take place in the mass sports industry as both industry sections shape each other (AA8). Digitalisation will blur company boundaries even further (ID2, 2017) and cross industry developments and innovations will become more important (AA8). Europe and Germany are not well prepared to this changes as innovation in sports industry are hardly funded by the government (AA8; NNOI). Radically new products or services cannot enter the market as not enough private or public funding mechanisms are available. Furthermore, there are no risk takers within a still quite stable industry, only little costumer orientation and no effort to make knowledge accessible (AAD12, 2016). There is no industry pressure that triggers changes (NNOI-III). In order to reach governmental funds for the development of innovative products in sports industry, adjacent industries such as the health industry need to be addressed. Funds can be applied for that area in Germany. Also, a certain relevance can be argued here as healthcare costs are rising due to demographic change and sports is necessary to keep citizens healthy (AAD12, 2016). For companies working on innovation in sports, health offers manifold new business opportunities (AAD12, 2016). Due to global competition in sports and country wide connections of associations, clubs and unions (IDB6, 2017), regional industry development plays only a minor role for networks acting within the sports industry. Other than in **Case I**, no traditional supply chain network is needed to create products. Additionally, due to the heterogeneity of actors in industry and scattered services, no central company is needed that can afford resource invest and implement ideas. In **Case II**, companies trying to innovate depend on governmental funds.

6.3.3 Network of collaborative relationships

As already outlined in the data processing chapter a network entity was the entry point for case study analysis (Yin, 1994) and network access was enabled by contacting the German funding scheme VDE/VDI (VDE and VDI, 2016) to ask for networks that has been funded in the past and that are independent now. The SIN, investigated in **Case II**, was supported by the VDE/VDI (VDE and VDI, 2016) and remained active after the two years support that was provided to further develop innovative technologies. As outlined above, in **Case II** as well as in **Case I**, it was particular important that the network was not dependent on public funds to exist in order to be able to investigate the Keystone.

The network exists since 2010 and was developed due to friends ideas. These friends had the same interests and were regularly doing winter sports together (AA2). They decided to apply for governmental funding to support their idea and got accepted by the VDE and VDI in 2010 (VDE and VDI, 2016). From that incident onwards, the network became a network entity (Wulf and Butel, 2017) as it had to provide an official label to get funded (AAD7, 2017). Out of the friends that applied for the support, the network core evolved. This network core always consisted of three to four agents that were significant in network development by actively influencing critical turning points in network history as displayed in **Figure 6.6**. They build a group of collective social capital (Lin, 2017) influencing network dynamics. **Figure 6.6** shows that two actors, A and B, were active from the beginning on, while one company got more important in the recent past. The other companies of the network core changed when the network adapted its aim from the ski to the sports innovation network. Partners from the former network core are now in the periphery of the network (NNOI-III). Consequently, Company A and Institution B are considered to be the core group that thrives network development.

As interview partners described the phenomena of a core group influencing the whole network development in several interviews conducted, the core group and their influence was considered to be important to identify the Keystone species as being part of the network core. As in **Case I**, critical

incidents mentioned repeatedly by interview partners were used to proof the influence of particular agents and are displayed in **Figure 6.6**.

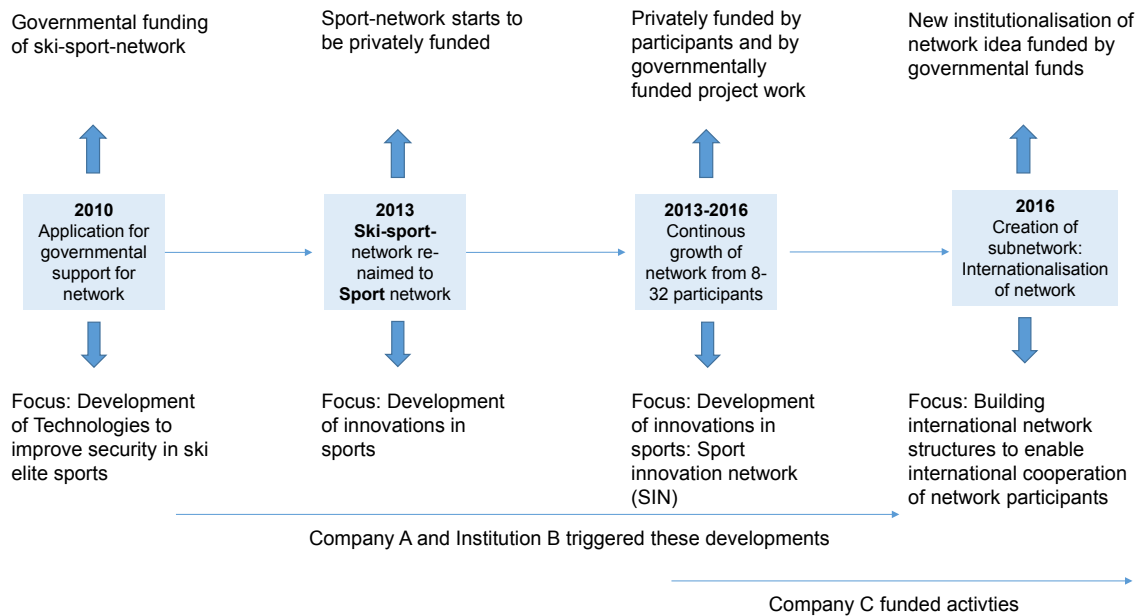


Figure 6.6: Critical incidents in the development of the SIN

During network development the network aim and vision were adjusted towards a broader network orientation. The ski innovation network expanded towards a sport innovation network (SIN). This evolution enabled not only a greater heterogeneity of participating network agents it also provided easier application for governmental funds due to a broader aim orientation and a broader knowledge base (March, 1991). The governmental supporting phase of the network led to an established network of more than 15 partners and a certain reputation within the industry. Especially the core group of the network was, and is, well connected to political institutions and important players in the sports industry (NND1, 2015). At the end of the governmental support, network participants were convinced about the importance of the network and decided to privately fund further network activities (NND1, 2015). Because of the same history and the passion for sport an extremely informal network developed that is shaped by friendship, trust and mutual interest (AA5). Today, the main issue for the network is the financial support, as the network core is the active part of the network that needs to individually finance its activities. Even though other network agents financially promote the network, not all activities can be funded by this uphold. Friendship ties between network agents are not shaped

by the same mechanisms as business ties (Dyer and Singh, 1998; Gulati and Singh, 1998; Caimo and Lomi, 2014), often business interests are not followed in order to not threaten the friendship (AA14; NNOI-III). Therefore, further network development lives from additional governmental support of certain network activities. One activity that reached additional funding in 2016 was the internationalisation of the SIN. Here, governmental funds are used to support the development of international SIN relations and enable international cooperation in innovative business area on the basis of existing relationships of the SIN (AAD6, 2016).

The network today, as in the past, is shaped by an active network core, and network partners in the periphery (Hojman and Szeidl, 2008) that want to engage in developments but do not want to influence actively the future of the network (NND1, 2015). Partners are companies, academic partners such as universities, research institutes and associations (NND1, 2015). Network core and participants in the periphery can be described as displayed in **Figure 6.7** adapted from a document that outlines the network structure provided by Company A (AAD8). This proves that Company A contains a birds perspective of the network, knowing what agents can actively engage. **Figure 6.7** displays that the network core shows a high activity and is the main pillar of the network that shapes network vision and aim (AA8). The size of the network core differs in size between 3-4 active companies. With the change of the network aim to a broader sport related aim, the network core changed slightly but Company A and Institution B were always part of the core group.

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 6.7: Network partnerships Case II: Network core and partners in periphery

(Source: adapted from AAD8)

Even though network participants in the periphery do not interact as frequently, they are involved when idea realisation is required (AAD8, 2008). Agents contributing to idea development are more proximate by joint activities than agents in the periphery (Pulles and Schiele, 2013; Hojman and Szeidl, 2008). Overall, network development showed that relationships and network structures modified when aim set changed and the heterogeneity of actors increased (AA7). The importance of certain agents will be outlined in the network agent section.

6.3.4 Trust, informal and formal network structures

In contrast to **Case I**, the SIN is mainly driven by friendship ties and by a certain informality. The active network core and companies being part of the former network core are connected by friendships. This influences all other relationships and enables informal interaction (Gulati, Lavie and Madhavan, 2011; Stacey, 1995). This is particularly notable in network meetings, creating an informal and trustful atmosphere (AA6; NNOI-III). Network meetings build the platform of interaction and enable the mutual development of visions and ideas. The joint decision making, shared interests and informality result in a certain stability and openness of network structures created by mutual trust (IB1; NNOI-III).

The network, being an institutionalised platform of exchange, enables to integrate other agents. Consequently, the network is influenced by formality and informality at the same time (Zheng, Zhang and Du, 2001). Formality evolves out of certain formal requirements for forming an institutionalised network. Informality results out of informal behaviour among agents. Still, as observed from incidents in the past, the evolvement of more complex network structures does not affect the friendship as well as the informality among agents (NNOI-III). Especially the current core group is still frequently interacting. These agents in the centre of the network also provide the platform of interaction for the other network agents. Their frequent interaction is the starting point for others to connect to specific subjects. Peripheral and core agents (Hojman and Szeidl, 2008) connect closer with a more frequent interaction when a project starts (AA7). Project groups work on well-defined goals with a certain output aimed at and require a closer connection. The network platform can be a connecting platform for those project groups to develop (AA7). Consequently, two platforms of interaction exist, determined by narrow or broad goal orientation, being a project and a network level of interaction (AAD8, 2008).

The network core forms the centre of activities (NNOI-III). Everyone in the network core has his own role. There is an agent who connects people, an agent who builds up political contacts and an agent who pushes implementation. All of these tasks belong to the specific interest the agents of the core group follow in the network (IB1).

Every one of these agents is connected well within his organisation (AA8; IB1). The friendship core has a charisma that influences even the employees of the organisations they work for. Within their company, agents mainly connect through informal interactions with each other (AA8). The same applies for connections with agents in the periphery. These relations are not based on friendship anymore but can be rather identified as informal connections resulting from informal interaction. Here, the most important connection is joint appreciation of interests (AA6), which can be personal or business interests that are addressed (NNOI-III). As personality and personal attributes are very important in informal settings, the agents of the network core control network access by personal fit

(NND3, 2015). Here again, informality results in a certain formality as network access is clearly defined by some agents of the core group in order to ensure friendly atmosphere. Especially organisations aiming only at individual profits would destroy mutual trust or a trustful atmosphere easily (AA8) as it occurred in **Case I** due to the presence of a dominating company (NNOI-VIII). Still, as the network is funded by network participants, it is important to provide a certain openness that enables development and implementation of ideas. A balance need to be kept between openness and growth as a strong increase in agents and heterogeneity would change the aim of the network and the complexity of interests (NNOI-III; AA8).

A certain open approach (Ahuja, 2000; Rowley, Behrens and Krackhardt, 2000) means that new agents often increase the periphery of the network (NNOI-III). Amongst network participants it is also considered to be useful to have partners in the periphery that contribute to project idea realisation (AA8). These peripheral partners could also be competitors. During investigation of **Case II** companies were collaborating with competitors at least for initial test of their knowledge base (AOIV). Three reasons could be discovered for competitors to align knowledge bases and collaborate. One was that they do not consider themselves to be competitors due to only small business areas that overlap, the second was that the formal relationship was not in the foreground but friendship (AA8). The third reason was that industry lobbyism was required in order to reach a greater aim. Especially because of current changes in sports industry, digitalisation was a subject competitors collaborated on (AA8), although these interactions were balanced well to not cross overlapping business (AA5). Long-term participations of competitors in the network were considered as being risky due to possible mistrust that could endanger informal relations and atmosphere (AA8).

6.3.5 Network cohesion

Other than in **Case I**, network structures in **Case II** could not be shaped by geographical proximity. All network participants are spread all over Germany and network cohesion needs to be kept by other mechanisms. First of all, the interaction among network agents differs, being shaped by a certain

formality between some agents and by informal interaction between others. Even though all network participants signed a formal agreement that states them to be part of the SIN, their interaction is shaped by informal behaviour. This also means that there are no communication standards, no participation standards or professional and hierarchical positions that might give guidance or influence network interaction (NNOI).

The informal behaviour among the friends of the network leads to an overall informal network culture, which in turn influences network cohesion and the willingness to share resources such as knowledge (Uzzi, 1997; Larson, 1992; Krackhardt and Hanson, 1993; Bosse and Phillips, 2016). In **Case II** network cohesion is therefore not kept by geographical proximity or frequent interaction but by mutual interest, trust and personal sympathy (AAD8, 2008). Therefore all these factors are considered by and enhanced in the network core, in order to increase network cohesion. Additionally, the industry and organisation's collaborative culture (Goh, 2002) helps to keep solidarity between agents as team spirit and collaboration is very important (AA8).

In terms of collaboration, impulses for interaction around certain areas of interest need to come from the network core. Agents active in the core trigger the development of the network. Especially, on network level only occasional interaction takes place (AA7). In contrast, project groups that evolved out of network activity are influenced by frequent interaction (AA8). Summarising the above, a positive and open network culture is needed to keep network cohesion that cannot be reached through geographical proximity. Company A and Institution B are part of the network core and keep the network alive (NNOI-III). They are aware that a triggering network core is key to enhance future developments (AA8).

6.3.6 Network vision and aim

As already described above, governmental funds are not easy to gain in sports industry. This influences the network aim and vision, as adjacent industries such as the health industry offer more support on combined health and sports projects. In addition, the elite sports industry offers funds for

technology developments. The downside of this support is that new technologies are not easy to implement on the market (NNOI). As outlined above, network activities are hardly covered by private contributions of network agents. Consequently, external funding requirements influence network vision and aim. As a result, for network agents in **Case II** it is even harder than for agents in **Case I** to match their company interest to network aims and vice versa, when network aims change due to funding requirements (AA8). This affects the strategic orientation of the network and of its agents. As the network is shaped by a rather broad network interest, together with heterogeneous actors, it needs a good network management in order to connect different areas under certain subjects to enable project work (DD1). Company A is the most active agent in regards to network management and tries to balance agent's interests trying to thrive the system as a whole (Iansiti and Levien, 2004b) to enhance interaction and exchange (NNOI-III).

Network agents interviewed and observed agree with the exchange platforms created by the network management. They see the broad network aim, and broader knowledge space (March, 1991) as more suitable for a general exchange platform rather than concrete innovation developments (IB1; NNOI; DD1). For them, the network is a platform as a source of inspiration (DD1). In contrast, project work is often more tailored to their own interests, being more closed networks (Coleman, 1988; Walker, Shan and Kogut, 1997). As every network participant follows its own aim, adjusting company and network aim is always a balancing act. Agents active in the network core were observed to constantly adjust company and network aim (NNOI-III).

Heterogeneous partners enhance creativity but also an increase the variety of interests. The higher the heterogeneity the harder to balance individual company aims and the network aim (NNOI-III; AA7). Still, a broad network aim is essential to get everyone with his specific aims and interest to feel part of the network. Therefore, Company A states that not all interests can be met in the network and it is important to enhance adaptability and flexibility amongst partners (Sawhney and Nambisan, 2007) and bring them to be open to completely new ideas (AA8). Dependency from governmental funds is perceived less influential by the network core than funds of private investors. The only private

investor accepted by the network core is Person C/ Company C, personally strongly connected to Person A. Without the funds of Company C, the network would have ceased. The network core sees that the economic interest of other large companies than Company C that bring in money can profoundly change the network (AA7; NNOI).

A broader aim enables resource heterogeneity and consequently opens up the network (Helfat and Peteraf, 2003; Grant and Baden-Fuller, 2004), especially as the SIN is already quite established engaging with new participants on a regular basis enhancing project work (AA2). This way the network increases and decreases by subject orientation (NNOII). Occasional heterogeneity and openness are therefore supported by other network agents and triggered by the network core. Summarising the above, network core agents not only actively influence network vision and aim, they are also aware of the necessity to balance their company and personal aim with network and other agent's interests.

As described above, two levels of interaction can be differed in the SIN, the network and the project level. Throughout time, the number of agents taking part on the levels differ (NNOI-III). When a project starts frequency of interaction increases and a smaller group of people interacts within a set time frame and towards a defined aim. Consequently, the knowledge shared differs as well, being more general and less applied on network level and specific on project group level (AA7). Even though project groups are often working on specific tasks, such as technological developments, only very seldom an innovative product is developed until market readiness (AAD9, 2013). Often a highly specialised product, which combines a lot of specified know-how (Kogut and Zander, 1992; Nonaka, 1994), remains as a prototype as no company wants to take the risk of market introduction. Even more so, as the market is shaped by strong regulations in regards to quality, ethical aspects and technology testing. Implementation is also often hindered by the lack of ability to finance a try out phase until market readiness of the prototype. Here, contacts to companies that are able to invest resources are necessary. Often these are big companies that are seeking for innovations (AA7) but do not accept a not invented here. Consequently, it is a balancing act to get big companies involved into project work

early enough to contribute to innovation, but not too early to influence interaction to their own interest (AOIII). Innovation is hard to be quantified at this stage and possible investors need to trust developments, as it can be only the invention of new ideas (Van de Ven, 1986). Therefore, the technological development needs to fit to their own product portfolio (AOIII).

In the past, only one product invented and developed by a SIN project group was brought to market readiness. The group that developed and implemented the product was a mixture of science, elite sports association, production and sales experts and was part of the network core and the periphery (AA6). It remained a niche product due to competition regularities that did not allow to introduce adjustments for athlete's specifications, as this would threat a fair competition (IDB3, 2017).

Still, all network participants benefit from these projects as they enable them to discover new areas of knowledge (McEvily and Zaheer, 1999) for their own organisation. Furthermore, all past projects were funded governmentally and gaining knowledge in new areas was therefore financially secured (AAD9, 2016; AAD12, 2016). The additionally gained knowledge also supports the network level and enhances frequent interaction. Events that address these areas of knowledge, such as meetings or network journeys, can take place (AAD11, 2016). This occurred for example with the 3D printing technology that was investigated among network agents to understand the impact on orthopaedics within the near future. This way the network is used to react to market changes (AA9). Within network meetings general strategic knowledge, product and business model knowledge is shared (AAD10, 2017). Often these meetings are open to other interested organisations to address new network agents and to get new ideas in, enabling the development of a sparse network (Burt, 1992; Hargadon and Sutton, 1997). Even though new agents often have not participated at a network meeting before, they immediately start to share what they know in the area discussed (NNOI –III). A positive dynamic that is influenced by trust, atmosphere, and mutuality of interest creating an open culture for KS can be observed (AA7; AA8; NNOI).

6.3.7 Network agents

As already described above, a heterogeneous mix of network agents influence the SIN. They all engage due to their personal or business interest into sports (NNOI). Network members can be a union, club or association, a research institution, companies based in the sport industry or adjacent to it, or companies not related to sports at all (NND1, 2015). The network is shaped by small and big companies, with profit or non-profit orientation. This results in different specifics that shape the network. Public funds are often only available when SMEs are part of the project group. This is due to the German support scheme for SMEs to improve their ability to innovate (VDE and VDI, 2016). When SMEs are brought into the project group two dynamics evolve. First of all, they are interested in new ideas as they often do not have the funds themselves to work on innovations. Second, they have a strong economic interest and but less resources to invest (AA8). They could not invest into market readiness of a product. In contrast, big companies can invest employees to attend to work group meetings if they are willing to (AA10). Consequently, the size of the company and its capabilities are important for its strategic orientation (Teece, Pisano and Shuen, 1997). This also influences the behaviour of the individual that acts for the company in the network (AA8). Big companies are hardly funded in Germany as they are considered to be able to invest their own resources. By taking part in funding projects they can profit from niche contribution and learn about new technological developments in different areas (AA7). When dynamics in networks are shaped by trust and interaction, resource exchange can take place among companies of different impact and assertiveness (NNOI-III). Even though there could be a win-win for small and large companies, these dynamics are threatened by the loss of interest of the large company or the inability of the SME to further invest its resources (AOI). Both partners often remain in a waiting position. SMEs wait until an idea is developed to see how they can contribute to it. Larger companies wait for SMEs working on niche products (Zahra and Nambisan, 2012), to develop a good idea (AA7). Additionally, SMEs want a concrete outcome, as they need to grow their portfolio, larger companies are often interested in new ideas and trend developments. Both companies often need to be convinced to invest resources

if not enough trust is available among network agents (AA8). Also inventions of these Niche players need to be protected, as despite patents idea replication or acquisitions can take place. It is important to reduce the risks of SMEs (Tiwana, Konsynski and Bush, 2010) considering their lower financial, human and technological resources and to enhance trust and KS (AAD12, 2016). It was observed that Company A tried to consider these dynamics, in order to enable positive network evolvement.

The more business interests are involved the higher, the strategic interest of network agents (AA10). For the SIN network core, the personality of individuals acting for their company in the network plays a major role on network dynamics. The network core sees a personality match as important as a strategical match to work successfully in the network and to create willingness to share resources (AA7). The company culture determines if individuals acting on behalf of their company in the network are collaborative or competitive (AA7). Consequently, when just a few network partners follow a certain strategic interest, a collaborative culture in the network is possible (AA7). SIN network agents follow a strong personal interest that can outweigh the strategic interest of their company if necessary (NNOI-III).

Additionally, the position of the agent individual in his company is key for developments in the network. Personality and hierarchical position are important, but influence within the organisation is even more important from the perspective of Company A (AA10). Meaning agents need to maintain a strong social network in the company (Stacey, 1995). Employees can have influence due to their personality even though they are no heads of the company (AA11). Influence is very important in order to span interests on different levels such as personal, company, project and network level (Corsaro, Cantù and Tunisini, 2012). Network participants found that everyone connects company needs with personality needs and confirmed that each network agent acts on both behalf's (AA11). If someone is personally interested but not supported by his organisation he has not the power to push his interests (AA8). This means that the network core of the SIN does not only aim for collaborative personalities but also for persons that are well connected and influential in their own organisation (AA10). Summarising this, network agents in the SIN network follow different interests due to their

heterogeneity and therefore influence network dynamics. Both need to be actively balanced. Furthermore, personal interests can be stronger than strategic interests if necessary. Network agents always consist of the company and the individual, balancing personal and strategic interest as well as network engagement. The network core tries to balance these dynamics.

6.3.8 Keystone identification

As for **Case I**, the Keystone agent in **Case II** was identified by observation, interview and network mapping results as shown in **Figure 6.8**. Main characteristics were related to answers of other agents, as well as observed characteristics. Furthermore, Network mapping questions were matched to agent characteristics the same way as displayed above in **Figure 6.4**. The network mapping method helped to not only to locate the Keystone in the network by asking for his relations but also to identify him by asking for the main trigger and developer of the network. **Table 6.2** displays that Company A received the highest number of respondents, stating the company to be the trigger of network developments (93,33% of the responses). As Company A was an active agent throughout network history, this is not a surprising result. Interestingly, Institution B received only one respondent even though network agents interact very closely with Person B/Institution B throughout network meetings and beyond (NNOI-III; AA10). As Person B/Institution B relate by their observed and stated characteristics very much to Keystone characteristics, the agent is considered further in sections below relating to Keystone agents.

Company Name	Number of respondents	Percentage
Company A	14	93,33%
Institution B	1	6,66%
Answers: 15 out of 27 network agents		

Table 6.2: Case II: Respondents on identifying the triggering network agent

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 6.8: Keystone identification by main Keystone characteristics Case II

(Source: adapted from Keystone description of Iansiti and Levien (2004a))

In addition to the tables above, **Figure 6.9** displays a network map to show the importance of Company A and Institution B. The figure shows business relations asked for (in blue) and relations based on interaction (in pink). As for **Case I**, answers are derived from the network matrix displayed in the results chapter. The graph shows that the Company A occupies a central position related to interaction and frequency of meetings, rather than to business relations. Interestingly, Institution B dominates business relationships. Again, and similar to the results displayed in **Case I**, the main triggering agent does not occupy business relations but relations based on frequent interaction. Taking network mapping results into consideration, together with network agent statements and observation, Company A can be identified as being a Keystone (NNOI-III). Even though, Person B acting for Institution B shows the same characteristics as outlined for a Keystone, the agent is not further investigated in the cross-case analysis. Still, due to his importance and his characteristics he is considered below. Here, the reason why he is not analysed as a Keystone is further outlined.

Person C/ Company C is not mentioned at all by other network agents, as they do not know about his funding activities (AA10). Due to the importance of C's investments for the network Person C/ Company C are as well considered further below in the agent section.

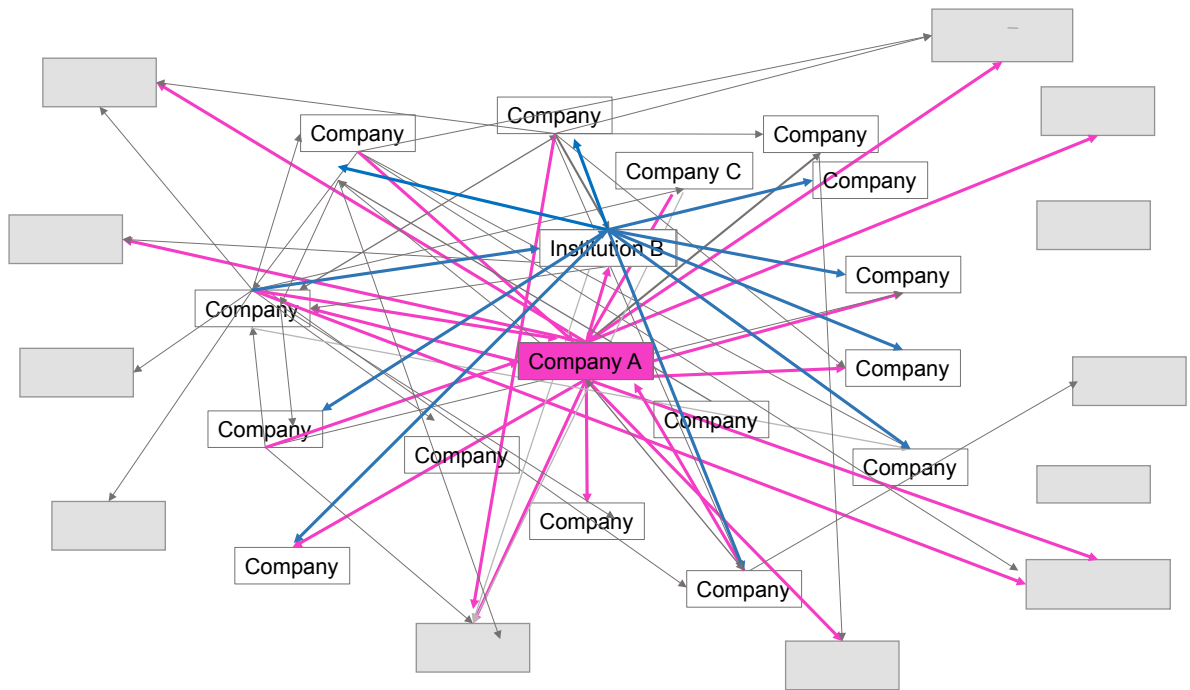


Figure 6.9: Network structure resulted from network mapping

6.3.9 Company A

As described above, Company A was identified as being a trigger of network developments. This can also be confirmed by network history and critical incidents displayed in **Figure 6.6**. The company was founded in 2000 as being part of a research institution. The head of the company was back then interested in science and innovation (AAD2, 2011), and part of the skiing group that had the idea to found a ski sports network. When that idea evolved, the company started the management of the ski sport network and applied for governmental funds. The network management idea was adjusted and extended throughout the years so that the company now governs distinct networks that are funded either governmentally or privately. All networks contain a pool of heterogeneous partners, such as technology development companies, research institutes, and political institutions on county and country level, cities, as well as trade fairs, providing a great variety of knowledge (Shafique, 2013). Some partners are big players within their industry but not active in the sports industry, such as for example automotive companies interested in mobility (AAD2, 2011). The company is nationally and internationally well connected (AAD2, 2011). When **Case II** was investigated in 2016, Company A

employed ten people and focused on project management and network management in sport innovation (NNOI-III).

6.3.9.1 Company characteristics

Employees describe Company A as being very informal (AA13). They are not sure about formal regulations in the company and every process is in a flow. Neither organisation charts nor job descriptions are available. New employees are not sought via job advertisement but solely through contacts and personal recommendations. No communication rules or hierarchical guidelines exist, responsibilities are not distributed, so everyone needs to seek his own responsibility (AOII). Employees stated that they would like to have more guidelines and introduced some processes themselves (AA13). They feel like there is a strong company vision that is also displayed in network visions but a strategy to reach that vision remains blurred for them (AA8). As they can identify with the vision introduced, they develop their own strategies to reach the vision lived by the head of the company (AA8). Altogether, the company culture is described as being informal, open, collaborative and flexible (AOII; AA13; AA8). The collaborative culture (Goh, 2002) explaining the organisation's collaborative network approach.

6.3.9.2 Company vision, aim and company strategy

As Company A is a small company, the company head and his vision directly influence the company itself. The company head describes the vision of the company as to give orientation for sport innovation and to be a creator of the future. He stresses the importance that everyone is a shaper and not only a reactor to future developments (AAD1). His aim is to offer a holistic view of innovation that enables him to not only react to, but also shape the future.

In order to reach that vision, the following strategy is outlined by the company head. Customers for his products or services are gained by his own personal network which is bigger than the SIN network alone. His main service is innovation management conducted for other companies (NNOI-III; AA8; AAD2, 2011). For him, product- and concept developments, development of methods and processes,

training and moderation, vision development are part of the offered innovation management. Network partners are needed to realise the innovative ideas. Holistic innovation means that heterogenic network partners are needed to provide industry knowledge and system knowledge (AAD2, 2011). He wants to discover new innovation fields, such as mobility and health for the sports industry, concentrating on knowledge exploration rather than exploitation (Liu et al., 2014; March, 1991; Spender, 1994; Grant and Baden-Fuller, 2004). Furthermore, holistic innovation means not only technology and markets, but considering also the human being in the innovation process (AAD2, 2011).

6.3.9.3 Network strategy and company business model

In order to reach the vision outlined above, a business model (Chesbrough, 2010) is needed that enables the realisation of holistic innovation. The company alone would be not able to reach these aims. Consequently, other agents need to be included through project as well as network management. Projects and networks can be funded by the government or privately, as already outlined above (AA7). Knowledge gained out of network connections is used by the company to address agent's needs strategically, the company adjusts company aim and network aim as well as agent's aims to each other (AA8). This is not only done by the company head but also by his employees (Jarzabkowski and Spee, 2009) as they constantly shape strategic ideas (AA11). Therefore, the generation of knowledge is a key factor of Company A's network strategy (AA8). Especially, strategically relevant knowledge is aimed at rather than technological knowledge. Technology is considered to be part of innovation success and is therefore a consequence of strategically relevant knowledge from the company point of view (AAD12, 2016). The company is constantly seeking for new ways of communication and cooperation between innovators in order to make knowledge accessible (Zack, 1999; Dretske, 1983). Furthermore, Company A does not only want to profit alone from this knowledge but include all stakeholders to reach its vision of future creation (AAD12, 2016).

To create new ideas everyone needs to bring in his own resources and Company A needs to trigger this exchange (AA8).

Company A's business model lives from institutionalised networks in different areas such as sports, mobility and elite sports and network agents paying for membership. Friends and agents financially not able to, often do not contribute pecuniary (AA10). The financial contribution hardly covers general network management activities. Openness and heterogeneity enable additional value creation for everyone (NND2, 2017; AAD5, 2017; NND1, 2015). Main tasks of Company A are to know what everyone has to share in network, trigger existing knowledge and match knowledge and competencies in order to satisfy other's needs (AA8).

These tasks can only be ensured by a well-developed network management. To provide this, networks need to be moderated and focused (NND1, 2015) enabling a competitive advantage for each partner and fast adaptability to changes (AAD2, 2011). Network knowledge need to be filtered by its strategical relevance in order to enable integration (Grant, 1996b), and informalities are used to access the people by addressing their personal motivation (Hwang, Lin and Shin, 2018). In order to reach the KS atmosphere, the company head knows exactly how to create a trustful and relaxed surrounding (AA8). Company A also works actively on network cohesion by ensuring frequent direct interaction among agents, for example through network meetings or network journeys (AA1). This is particularly important, as the company head realised that room for idea development is key (AA2). Network meetings are a platform of interaction that gets everyone to know each other and to have a direct, informal contact shaped by a casual atmosphere (AA2; AA3). This unofficial and informal behaviour is very important to keep proximity and trust (Stacey, 1995; Granovetter, 1973) between partners, even though they do not see each other often (A8). Furthermore, mutual interest and exchange (Teece, 1998; Levin et al., 1987; Grant, 1996b; Pulles and Schiele, 2013) is considered by network aim orientation and open communication is enhanced during the meetings. One way to trigger an open and lively exchange is to address people by their personal interest (Bosse and Phillips, 2016), as the company head is aware (NNOI). When personal interest is addressed a positive group dynamic

evolves and knowledge is shared that could be relevant for innovative ideas in a specific context (AAD4, 2008; AA8). Company A wants to build an innovation culture in this meetings and tries to combine personal and strategic interests of all stakeholder groups by fostering their imaginations (AAD3, 2011).

Network management means managing and leading at the same time (AA7). One central task of Company A is to adjust network aims to funding possibilities and the aims of network agents, in order to keep them active (AAD12, 2016). As already explained above, heterogeneous partners were necessary to get knowledge in and broaden network aim (March, 1991; Sawhney and Nambisan, 2007) but also led to a difficult network aim definition to ensure every ones inclusion (AA2). Project and network level agents and their aims need to be considered, as well as future developments. In order to reach network aims, Company A also regulates access to the network by looking for personal fit and partners that contribute to a possible governmental funding (AA7; AOIII), using social control mechanisms (Rowley, Behrens and Krackhardt, 2000). Also, Company A employees are convinced and aware that agent's personal and company interests need to overlap to have engaged people in network (AA8). This knowledge helps them to engage in the network on Company A's behalf (NNOI-III). Company A profits significantly from network management as it not only manages a high number of contacts but is also addressed for project work by other companies due to its contact pool. Additionally, Company A learns a lot about possible market developments as well as business opportunities (AA7; AOIII).

Some problems result out of Company A's characteristics combined with the network management task. First of all, the informal orientation of the company head, being shaped by the network core consisting of friends, influences the ability to build up business relationships. Even though, all network participants are connected with Company A, by formal agreements confirming their network membership, they do not perceive Company A as a business contact. Company A struggles to stick to formalities such as demanding the payment for network membership (AA8). This is confirmed by the network mapping results displayed in the result section, showing that formal contacts are not

based on connection with Company A but with Institution B (NNOI). Consequently, the business model lacks its funding due to company's head relation philosophy. Furthermore, the unique selling proposition of the company is not only its holistic innovation approach but also its contact pool. Naturally, it needs to balance contact protection and contact usage, in order to satisfy network agents and customers. Meaning actively maintain the platform of interaction (Isckia, 2009). Additionally, as competence and contact matching is not a visible service, it is hard to get others to pay for it, that are not part of the network but part of the company head's network (AA8). Still, these agents are needed to ensure openness, variety and heterogeneity of ideas and knowledge shared (AA12). As network membership fees hardly covers network activity, Company A needs to look for investors, large companies or governmental funds to bring in the lack of resources (Zahra and Nambisan, 2012). Investors are often only interested when ideas are concrete (AA7) but a try out phase needs to be financed as well. Therefore, a certain dependency from big companies and governmental funds shapes the network, which again influences the network aim. Company A needs to constantly balance (Iansiti and Levien, 2004a) these dynamics (NNOII). In order to keep big players and Niche players in the periphery of the network, certain project outcome is required. Due to lack of innovation implementation so far, it is hard to keep agents that seek for project outcome on a long term basis (NNOI). This is especially the case with big companies that can invest resources but also sometimes with small companies that do not want to invest any resources any more (AOII). Ideas of employees to develop paying models for different services provided for actors that are not part of the network were not introduced due to the company heads philosophy (AA14). Additionally, projects were rejected in the past due to their missing relevance for company vision (AA8).

6.3.9.4 Company A-Person A

As confirmed by interviewees, the head of Company A was identified as a Keystone in **Case II**. Being the head of the company, together with two other directors, he shapes company vision, aim and strategy significantly with his behaviour (De Witt and Meyer, 2010). Therefore, his personal interests

play a vital role, especially his philosophy that informal behaviour enables access to people (AAD2, 2011). Essential for him is to match his own personal interest with a higher interest, such as shaping future developments (AAD1, 2011). He decides by personality if someone is potentially important or not (AA10).

He also knows that a certain dependency of big companies and governmental funding exists when it comes to innovation implementation and concrete projects (AOIII). Still, he finds it hard to push for realisations or follow predefined steps to reach aims (AA8; AOIII). Due to his personality, he connects on a personal basis with his employees, which results into a very good understanding of his vision and his philosophy due to direct and frequent interaction (Gulati and Singh, 1998; Palmatier, Gopalakrishna and Houston, 2006). Employees adapt to his behaviour and connect personally to network participants as well, while the company head remains an important part of the network core (AA8). Awareness about social changes and resource needs among network participants are important as well as an optimal resource invest (AAD8, 2008). He calls himself a moderator and a living platform and tries to get everything possible out of situation as he wants everyone to profit from the network (AA6). This also means that he does not invest much time into people he finds not useful or interesting. He is aware about how network structures are built up and what can be reached through formal and informal interaction (AAD8, 2008), but he is sure that competence matching and KS only take place in informal structures (AOIII). His strong outward orientation sometimes dangers his company, but he perceives the company as part of the network and not so much as an own entity. This connects his vision and aims to network vision and aims and enables him to combine company and network strategy with each other, but weakens his business model (AOIII). Due to his network business model, he has a great number of contacts and as he cooperates very closely with the network core using their connections. These connections the network core started to use at the end of the investigation of **Case II** and will be explained below. Many more characteristics and actions were found during investigations and will be outline in cross-case analysis in more detail in combination with **Case I**, in order to describe the Keystone species.

Especially, Company A employees suggested that the centrality of Company A in network structures, taking advantage out of its position (Ahuja, 2000; Snow, Miles and Coleman, 2000), should be used more. Information about resources and competencies of all network relations should be shared better. Consequently, the network core used its contacts to the sports and mobility industry and to politicians and started to develop a meta network with the aim to provide an innovation hub for athletes, unions, clubs, associations and companies in sports industry. All these actors get connected, in order to create a broad exchange platform, such as a BE platform (Mäkinen and Dedehayir, 2012). The network core called this development BE development with the shared vision of meeting mega trends the industry is facing (AAD12, 2016). Due to political connections of the network core, they are often called lobbyists by other network agents (DD1; NNOI), as they started to connect to politicians with providing their ideas on country level to support the BE development governmentally. Plans for the innovation hub are put into federal budget for 2018-2022 (NND6, 2016). The same project was started for the automotive sector, as mobility is perceived the future subject that affects the individual on different level funding (AAD13, 2016). So far, mobility was not a core subject of the other two partners of the network core and was therefore not pushed as much as innovation in sports industry. Mobility subjects were raised mainly due to Person A's interests and contacts.

Person A and the network core wants to further use available network structures towards a certain vision (AAD1, 2011) and consider new trends and perspectives as early as possible (AAD2, 2011) by pre-determining innovation fields in their BE (AAD1, 2011). This should not be done for self-fulfilment but to create added value for the whole industry (AAD2, 2011).

As the network core consists not only of Person A/Company A, the other two active agents are introduced in the following and outlined briefly due to the following reasons. Person B of Institution B was identified by network mapping as being one of the triggering persons in the SIN. Company C was not mentioned by network partners but was observed in different network meetings and mentioned in a number of interviews as being a key contributor to the network due to its financial support (NNOI). First of all, Person B acts completely on the basis of personal interest without any

support of its institution (Arya and Lin, 2007; Caimo and Lomi, 2014; Zander and Kogut, 1995; Bosse and Phillips, 2016). Additionally, Company C has no strong strategical interest as Person C is a close friend of Person A, acting as well on the sole basis of personal interest. Both were identified due to their relevance for network dynamics. Their network removal (Iansiti and Levien, 2004a; Power et al., 1996; Stead and Stead, 2013; Clarysse et al., 2014), Person B because of his contacts, Person C because of financial support, would threaten the survival of Company A and consequently of the network (NNOI; AOIII).

6.3.10 Person B

Person B identified as the second Keystone of the network has excellent connections to the elite sports industry, politicians and athletes (NND4, 2015). He belongs to the friendship core (Lin, 2017; Hojman and Szeidl, 2008) and has been influencing the network throughout its development displayed in **Figure 6.6** (AA10). He is accepted by all network participants that are close to the network core and he enjoys certain authority. For some network agents he is still the central person of interaction (AA8; NNOI-III). He is engaged due to his personal interest into elite sports and winter sports and his passion of skiing. His contacts result from his work experience in the industry and from his country wide success in the ski industry. Being one of the closest friends of Person A, he supported the network at all times and was one of the key agents to develop the niche product they introduced to the market (IDB2, 2016). He coached athletes on all levels of competition and works for an association in elite sports. He has to push himself towards innovative ideas as his institution does not support any new ideas (IDB4, 2016). Additionally, he sets up his own personal network on innovative technology development for athletes' protection (IDB5, 2016). He is renowned in the association he works for and he is well connected to the Institution board, as positions were established solely for him (IDB1, 2011). He is aware of the strong competition and the existence of formal rules in his industry and compares it with a bureaucracy (IB1). Because of that he likes informalities and tries to develop parallel structures to the existent formal structures to reach innovation in the field.

6.3.11 Person C

Person C can also be characterised by his personal interest into sports. Additionally, he pushes a certain research interest of his company. Due to his influence in Company C, he manages to invest his own resources into network activity on a basis of a personal interest. The company he works for is consolidates with a big company in the chemical industry. His subsidiary is the part of the company that is delivering continuous growth. They are interested in new use cases for chemical connections they produce. He connects with the SIN to get new ideas for their products and as he is personally interested in Sports (NNOI-III). As a long-standing employee, he is well connected in his company and due to his friendship with Person A, he manages to regularly support the network financially. Without his financial contributions and his trust into the network core network activities would not exist anymore. He is not actively triggering developments but he believes in the network vision (CCD4, 2016). His company experiences a continuous growth and is shaped by hierarchical and inflexible structures (CCD3, 2016) that is why he thinks he needs to engage in network activities (NNOI; CCD1, 2016; CCD2, 2017). In the past, certain research projects evolved out of network activities (AOIII), but he said he still needs to push for his network engagement as his company is not convinced about the network outcome (NNOI).

6.4 Summary

The chapter above outlined not only industry specifics and particularities of **Case I** and **Case II**, it also enabled to identify Keystone agents and outline some of their main characteristics.

Summarising both case studies and their Keystones, the following is essential for the next steps of the research. Considering outcomes of **Case I** and **Case II**, Keystones in business surroundings need to follow not only personal but also strategic interests in order to keep the BE healthy. In addition, individual and company characteristics and actions are important to understand Keystone specifics. Consequently, as in **Case I**, Person B/ Company B and Person C/Company C, and in **Case II** Person A/ Company A, were identified as Keystone agents following not solely a personal but also a strategic aim, these agents were investigated in more depth for the cross-case analysis, displayed in the findings chapter. The emphasis of **Case I** differs slightly from **Case II**, as in **Case I** two Keystone companies are investigated, whereas in **Case II** only one was available. Nevertheless, **Case II** offered an in-depth analysis of Person A/Company A that enabled to understand the company perspective in more detail. In summary, all individuals and companies contributed significantly to understand the Keystone role, its characteristics and its strategy and the strategic aim followed on collaborative relationship level. The term Keystone is from now on used for all of the three companies and individuals, as mentioned above.

7. Findings chapter

7.1 Introduction

This chapter displays the findings in front of the relevant literature. Constant comparison with data and theory is essential (Eisenhardt, 1989a) to enable the building of new knowledge and theory (Eisenhardt and Graebner, 2007). The comparison of data and theory takes place in this chapter when major findings are discussed. In order to build theory from qualitative analysis, it is important to match existing literature very closely to the findings explored. While the literature review has outlined the research gap, it is essential to link existing findings to the described theory in order to find answers to the research questions formulated. Consequently, in this chapter every section will shortly outline the phenomena explored, will then relate back to literature and as a final step will relate new findings to existing literature. All findings are arranged in a logical order that relates back to certain concepts or models described for that phenomena to provide a comprehensible display. This means that the raw data that has been collected through the data collection process is arranged in an understandable meaning to make it accessible to the reader. It is important to enable a display of findings that developed out of a recursive cycle of matching literature, existing concepts and findings to each other. This also enables a more objective results display as it keeps the researcher close to the existing knowledge in the field (Eisenhardt and Graebner, 2007).

This process is considered by applying the conceptual research framework introduced in chapter three in **Figure 3.3** and extending it by adding Adner's (2017) dimensions of BE research, in order to provide a comprehensive research of the Keystone role. These dimensions could be applied after data coding, as data related back to similar dimensions. **Figure 7.1** shows the extended conceptual research framework. The application of Adner's (2017) dimensions is outlined in detail in subsection 7.3.2.

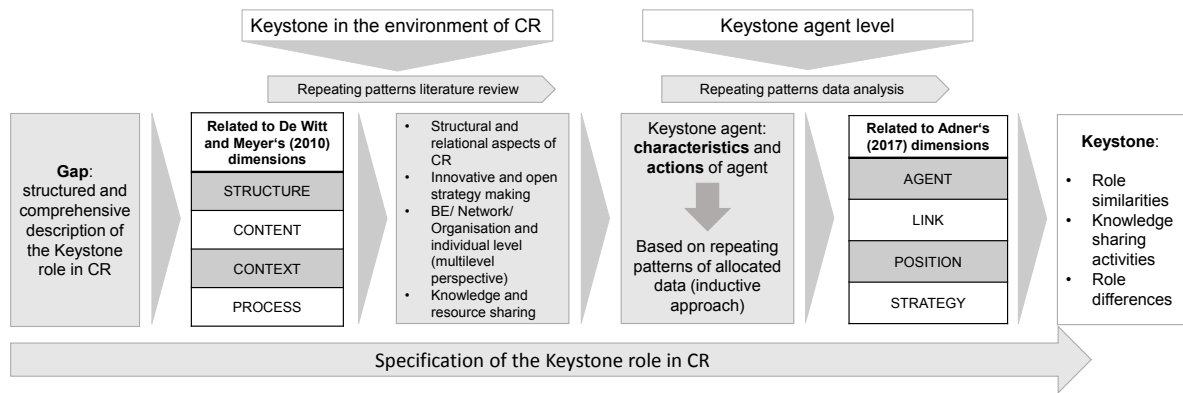


Figure 7.1: Conceptual research framework added by Keystone role dimensions

In the data collection and processing chapter the data generation process was described in detail. In addition to that, this chapter focuses on how data was transferred into generalizable findings and how these findings relate back to literature. In order to understand the complexity of data accessed, the following paragraph outlines what method enabled data access and how this data was then summarised to presentable findings.

As described in the chapters before, data collection started with expert interviews. The expert interviews enabled to understand the context the Keystone acts in in greater detail and helped to focus case study research. As the interviews were semi-structured, the data derived from expert interviews was summarised by using the main sections of the interview guideline. Here, all statements were collected and coded by their meanings so that main statements as a summary of the coding section were developed. These main statements were then used for the data display, listed by numbers of nominations and are shown in the first subsection of this chapter.

For the case study research, all data was accessed from multilevel perspectives. Here, a great variety of interview statements, observations and secondary data needed to be considered. As explained in the data collection chapter, the entry point of analysis was the network level to identify the Keystone agent. The Keystone agent, being Keystone individual and Keystone organisation, was acting on different levels such as the organisation, network and BE level. Therefore, the findings displayed for case study research always related back to the level of interaction they were explored at. This means

that, findings on organisation level were derived mainly from interview statements of employees of the Keystone organisation and the Keystone individual itself and supported by other data accessing methods, such as observation and interviews with other network members, as well as secondary data analysis. Whereas findings on network level were derived mainly from observations on network level supported by other data accessing methods such as interviews with the Keystone and other network members. BE level findings were mainly derived from open network meetings that enabled other BE agents to access the network as well as interview statements from all network agents and secondary data analysis.

Additionally, to the multilevel perspective of data access, the Keystone was investigated as being an individual and an organisation. Therefore, findings were structured on individual level as well as on company level. For the individual level observation, Keystone interviews and other member interviews were essential, for company level mainly Keystone individual and Keystone organisation employee interviews, as well as secondary data analysis, were used. As all data access methods were essential for all perspectives taken, they enabled to understand the phenomena explored only by taking all perspectives into account as displayed in **Figure 7.2**.

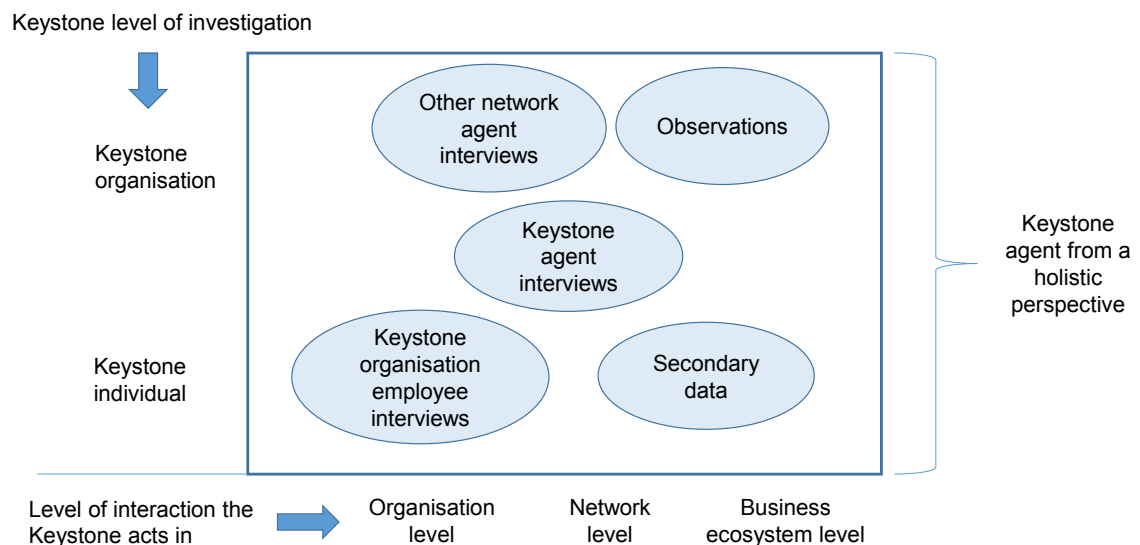


Figure 7.2: Methods used to enable a multilevel perspective of the Keystone agent

Figure 7.2 shows methods used to enable a multilevel perspective for different levels of interaction and different levels of the Keystone role, being the individual and the organisational level. This multilevel and multimethod approach ensures a holistic view of the Keystone as the Keystone agent in this study is seen as acting in CR, and not as acting as an isolated agent. Furthermore, data and method triangulation was enabled for the findings related to the Keystone individual and the Keystone organisation as shown in **Figure 7.3**.

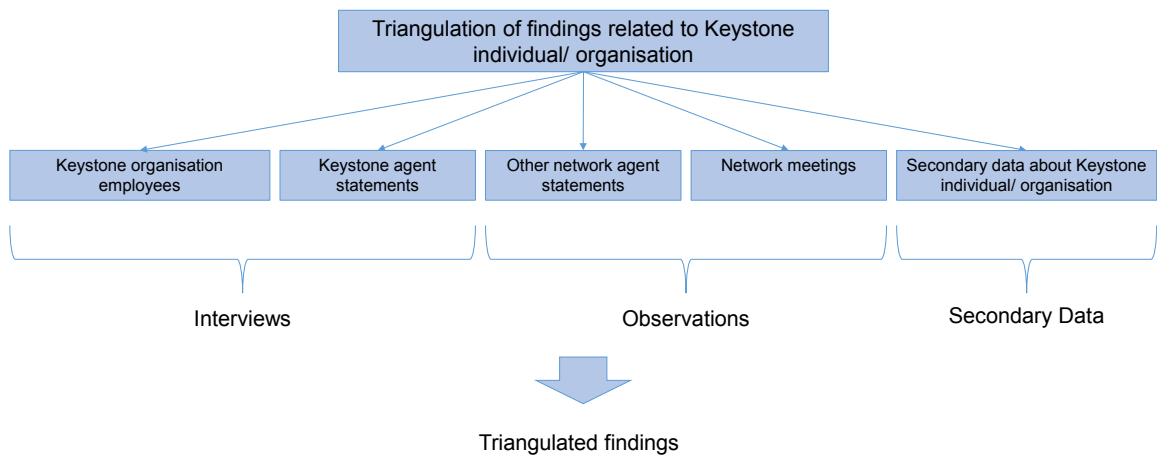


Figure 7.3: Triangulated findings

All statements made in interviews, observations made in network meetings and secondary data were then clustered by their meanings. Clustered statements were related back to the research questions and were arranged in a structured way to answer the research questions. **Figure 7.4** displays the explained data access and allocation.

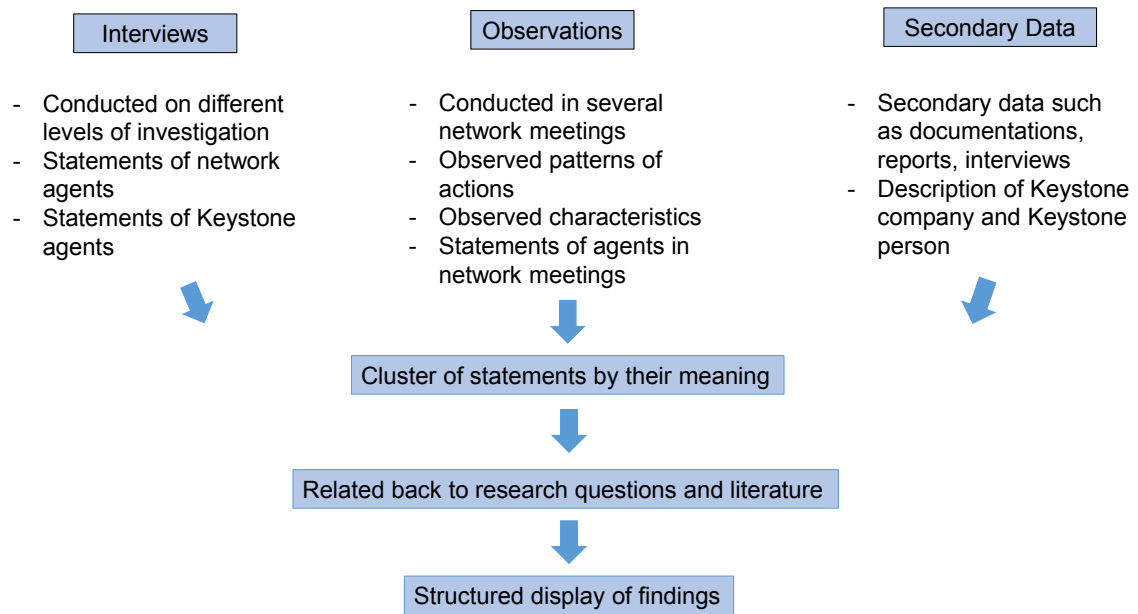


Figure 7.4: Data arrangement and display of findings

Figure 7.4 shows that data was arranged by its meaning and by being related back to literature as described above. While considering the research questions, the findings explored and relevant literature, the following structure of this chapter and its subsections were developed as shown in **Figure 7.5**. The figure displays the expert interview sections structured by subjects of the interview guideline. For case study research, the three main research questions are taken as order of the subsections. **RQ1** refers to the Keystone role asked for, **RQ2** to KS of the Keystone and **RQ3** to Keystone differences in distinct CR. The subsections are structured considering concepts explored in the literature review that will be referred to in more detail in the very subsection.

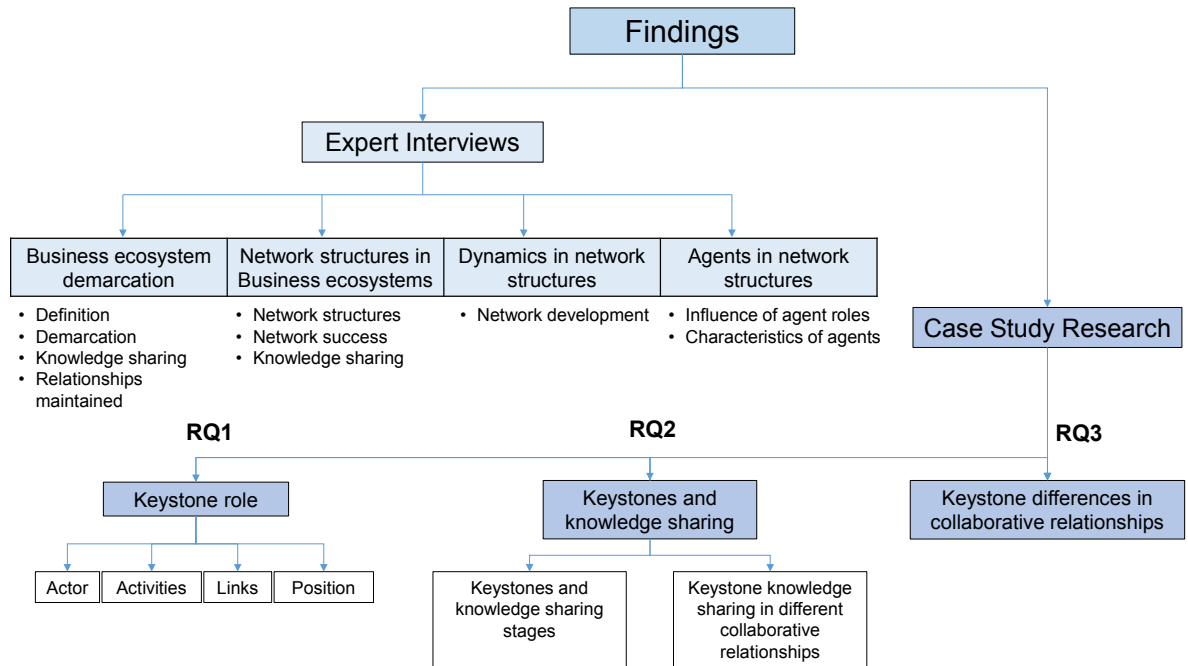


Figure 7.5: Structure of the findings chapter

7.2 Expert interviews: display of major findings

As already outlined above, this section displays major expert interview findings. As the expert interviews were conducted as semi-structured interviews they were structured to verify and support the conceptual model referring to the environment the agent acts in. The conceptual model, in **Figure 2.7** and **2.8** in chapter two, shows the dynamics that influence the BE and its agents. Therefore, the findings stated here enabled the researcher to understand dynamics influencing CR and agent behaviour and to focus on certain aspects in case study research. Additionally, first agent characteristics were outlined that supported the Keystone selection for the case study research. Furthermore, the expert interview findings are later used to underline important case study results. As stated in chapter four, ten experts were interviewed that were considered experts as they had at least more than two years work experience in the field of network management, seven of them still occupying an active position. More details on the selection criteria of expert interview participants are stated in **Table 4.1**.

The following areas of investigation were addressed in semi-structured interviews in order to

understand CR the Keystone agent acts in and the role itself:

- BE level (for BE and network demarcation)
- Network level (for understanding network structures and network dynamics)
- Organisational level (to understand key agent roles)
- Individual level (to understand key agent roles and how knowledge is shared)

As shown in **Figure 7.5** these interview categories resulted into the following sections for the findings display:

- BE demarcation
- Network structures in BEs
- Dynamics in network structures
- Agents in network structures

Every section will start with a short introduction of the category investigated and continues with discussion of main contributions in front of the relevant literature. Main contributions are summarised expert statements following the data arrangement process stated in **Figure 7.4**. Statements that were mentioned by most experts and that received the highest number of nominations per statements are structured in result tables. The number of nominations might be higher than the number of experts as experts can have mentioned the subject more than once. This often happened when experts found the subject particular relevant and referred to statements more than once. The number of nominations is only mentioned separately to underline certain findings when they differentiate to expert numbers or when the number is notably higher. Numbering expert contributions supports the derivation of major findings to concentrate on statements with a certain importance. Major findings are explained by referring to the percentage of experts being consistent with the statement. Only statements that were supported by more than five experts, meaning 50% of experts consulted, were considered for the result display in tables. Statements with a high number of contributions are highlighted in grey and discussed as major findings. When tables contain several statements such as in **Table 7.1** a summary of the statements is provided in the last column to enable a better understanding of what major

statements outlined. Statements related to the different sections can overlap by their meaning, as experts sometimes connected answers of distinct questions with each other. Overall, this contributes to the understanding of interrelations among categories.

Business ecosystem demarcation

In order to understand BEs in front of long-standing concepts and theories such as network theory or the KBV, this subsection on BE demarcation concentrates on expert statements about how they understand BEs and networks, how knowledge is shared and what role collaboration plays.

Table 7.1 shows that the most frequent mentioned statements to demarcate BE and networks related to BE and network structure. 100%, meaning all experts, were coherent in saying that BEs are the environment of a network. BEs are seen as a bigger structural entity than networks (supported by 70% and 20 nominations). 100% of the experts support that networks are a governance entity or platform of interaction within the BE. Consequently, experts used the term governance entity or platform of interaction simultaneously to subscribe networks and BE as being structural entities shaped around a vision or aim. But in contrast to a network, BEs are a bigger structural entity that also shaped by relations and therefore based on network structures. This understanding of BEs can partly be found in literature as well, but BE and networks are not linked as directly to each other as the consulted experts did. Researcher see BEs as complex, adaptable systems that developed to face the today's fast changing world (Williamson and DeMeyer, 2012; Heikkilä and Kuivaniemi, 2012; Borgh, Cloudt and Romme, 2012), shaped by a high number of heterogeneous agents (Moore, 1993; Rong et al., 2015) being extended supply chains (Rong et al., 2010; Adner and Kapoor, 2010). Still, Isckia (2009) for example found that business networks are to be seen separately from BEs. Additionally, 80% of the experts were consistent in saying that BEs evolve through an economic force field that can develop due to governmental support or economic strength of certain companies, in which not all actors need to directly interact. The term economic force field was introduced by experts and during case study research, and refers to an idea or vision that creates a certain economic strength. BE structures contain many different collaborative relations that are themselves again

grouped around a shared vision or aim, creating an economic force field, that is maintained through a platform of interaction on either network or work group level.

Whereas researcher state that BEs contain platforms of interactions where all agents are connected (Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012) all experts consulted, being a 100%, see BEs as containing several platforms on different levels of interactions such as the BE, the network and the working or project group. These platforms grouped together build the BE or network, and agents are connected by interdependency due to the same aim orientation (supported by 60% of the experts).

Summarising the contribution of experts on BE and network structures, they see the ecosystem as being shaped by direct or indirect relations that are interdependent due to a certain aim orientation. They introduce a new idea of several platforms of interaction, forming subsystems of network relations bound together by a certain aim building substructures of the BE. As relations are the basis for governance entities they can be formal and informal. Due to same interest or aim followed in the economic force field of developments, the agents belong to the subsystems they act in, as well as to the BE. The expert's understanding of BE structures is displayed in the diagram of **Figure 7.6**.

Knowledge is considered to be an important resource to be shared. Loosely knit ecosystems can be hold together by knowledge exchange (Iansiti and Levien, 2004a) and a BE platform is an important KS hub (Shang, 2014). Additional to the importance of KS in BEs, 60% of the consulted experts mentioned explicitly that different network structures, such as informally or formally shaped relations are used for distinct knowledge exchange in BEs or network structures in general. Not always knowledge can be shared by formal mechanisms such as advice relations. In BEs even less so, as relationships are often not shaped by direct interaction enabling a certain control. Therefore, BEs often contain a number of different governance entities or platforms, such as networks, work groups or cooperations that are shaped by greater or smaller openness in order to enable a certain KS activity. Which could result in creating a closed platform for specialised KS consisting of formalised network

relations, using CR as a tool for KS. Experts did not further specify who is responsible for the use of network structures on BE, network or work group platforms.

Relations in network or BE structures can be shaped by competition, cooperation, collaboration or co-opetition (Peltoniemi, 2006). The results shown below in **Table 7.1** underline this understanding. 60% of the experts consulted mentioned themselves that relations result of direct and indirect interaction. Dependency and competitive relations can exist in BEs as well as collaborative and cooperative relations which results in co-evolution. The experts did not differentiate between collaboration and cooperation.

In summary, BEs and networks are based on relational structures that can be clustered by a shared aim or vision and build a governance or structural entity, also named platform of interaction, to reach that mutual aim. In order to reach the aim, knowledge need to be shared. Depending on relation type different knowledge is shared. Network relations are used to enable KS by building up network structures on different platforms of interaction. **Figure 7.6** shows how experts describe BEs in comparison to networks in **Table 7.1** considering the findings outlined above and summarising to a graphical display. The figure displays network relations as the basis for distinct platforms of interaction on cooperation, project or work group level and network level. All these relations can be summarised to a BE based on an economic force field developed out of a vision and aim.

Category	Subcategory	Main statements	Number of experts	Number of nominations	Summary of results
Business ecosystem	Business ecosystem definition	Business ecosystem can be seen as the environment of the network.	10	13	Business ecosystems are a bigger structural entity than networks. They develop around an economic force field, that can be created by governmental or company forces. Business ecosystems are built up by relations which do not need to be shaped by direct interaction.
		Network are a structural entity or platform within the business ecosystem.	10	12	
		An economic force field is reason for network development and can be seen as underlying dynamic for co-evolution.	8	10	
		Not all actors are in direct interaction within the business ecosystem but they are dependent on each other and co-evolve.	8	8	
		Business ecosystems are bigger than networks when they are seen as a structural entity or platform.	7	20	
		Business ecosystem development is possible as top down development, such as from political structures and funding creating an economic force field. Business ecosystem development is possible as bottom up development around a grown economic force field often led by a company.	6	6	

Category	Subcategory	Main statements	Number of experts	Number of nominations	Summary of results
	Network definition in demarcation to Business ecosystem	Network relations can be seen as structural elements, to build up contacts and connect members of the business ecosystem (network elements as a tool or instrument).	5	5	A network can be forming a structural or governance entity or a structural element. Structural elements can be shaped by formality or informality. These relations are shaped by the same aim or interest. Relations can be used as a tool to exchange resources.
		Network structures can be seen as forming a governance entity (such as business ecosystem, network or project group)	10	16	
		Same interest, such as a common aim, triggers network development and holds network together. A common aim is the basis for formation of network relationships.	6	10	
		Network aim also influences network structures. Different aims require different types of relationships.	7	8	
		Formal and informal relations resulting out of network relation between agents are the basis for network structure.	7	7	
		Networks can be seen as a tool within the business ecosystem to exchange resources (such as knowledge).	5	7	
	Knowledge sharing	Different network structures in business ecosystems are used for different knowledge exchange.	6	6	Different relations or structural elements in networks are used for different knowledge shared. There are distinct knowledge sharing mechanisms dependent on the relations existing in networks or business ecosystems. Formal structures shaped by control, informal structures by trust. Innovation happens where variety is high: edge of networks or clusters.
		There are distinct knowledge sharing mechanisms in different network structures (formal structures, control, informal structures trust).	5	5	
		Tacit knowledge is shared mainly in closed structures (formal or informal control high).	5	6	
		Innovation happens on the edge of networks or clusters within business ecosystems.	5	6	
	Relationships maintained	Relations are shaped by interaction and interaction is shaped by relations.	6	7	Relations and interaction at the basis of exchange. Collaboration and cooperation is the basis for interaction and exchange driven by same aim. Different relations enable different exchange. In business ecosystems agents can have relations due to dependency on each other.
		Different relations enable different interaction and exchange.	6	6	
		In business ecosystems relations are not necessarily shaped by direct interaction but for example by dependency (e.g. competition).	5	9	
		Relations are determined by cooperation which can be on a formal and informal basis.	5	5	
		Collaboration and cooperation is on the bottom line of all interaction and exchange. Trust needed to collaborate or cooperate.	5	8	

Table 7.1: Demarcation of business ecosystems and networks

Figure (Extract/ Text/Chart/Diagram/image etc.) has been removed due to Copyright restrictions.

Figure 7.6: Demarcation business ecosystems and networks

(Source: adapted from Wulf and Butel, 2017)

Network structures in business ecosystems

This category asks for network structure elements, constitution of network aim and knowledge sharing in network structures. Building on the above, network structures were outlined more specifically by the experts as shown in **Table 7.2** below. The reason why network structures were asked for in more detail was because experts mentioned that network relations could be used as a tool in BEs. The possibility to consciously use network structures needed a clarification.

Overall, all of the consulted experts (100%), underline again that networks and BEs can be governance entities or platforms shaped by different types of network relations. Another 100% of the experts agree that network structures can be more formalised or more informal depending on relations type which corresponds strongly to findings in network research (Caimo and Lomi, 2014). A mutual aim shapes the relationships by determining agent interests and type of network. All ten experts (100%) emphasise that network access is important for the network, as the degree of openness of the network as a platform has a direct effect on KS. They specify that the type of knowledge shared depends on the room for KS. Specified and also more tacit knowledge can be shared closer structures

whereas broader knowledge is shared in more open structures. Relationships build on trust are no friendship relationships but business relationships that are not relying on formalities, as addressed by 50% of the experts. Trust substitutes formal structures but they also revealed that formality is needed to ensure that the network is not accessible by everyone. Also, friendship ties can hinder the development of business relations. Relations can be maintained consciously to enable influence and KS. These considerations are not new and confirm **Figure 2.8** in the literature review that refers to platform openness, network governance and knowledge space building a part of the conceptual model.

Researchers found as well that types of relations can be influenced and enable the individual firm to think about its strategic movements and set its own game rules (Isckia, 2009; Zahra and Nambisan, 2012). Nevertheless, CR so far have not been explained as being a tool to manage platform interaction. Influencing network structures means to be aware of different governance mechanisms such as informal and formal exchange which are known to influence KS (Jones, Hesterly and Borgatti, 1997; Rowley, Behrens and Krackhardt, 2000). Experts add to that, by stating that friendship ties need to be treated differently than informal or formal business ties as friendship ties do not foster business.

Relation type and network access can influence the knowledge space a company can address in CR (Shafique, 2013) and open and sparse networks (Burt, 1992) can be influenced distinctly than closed networks (Coleman, 1988) as outlined in the conceptual model in **2.9**. The possibility to develop innovative knowledge is affected by these aspects as well (Sawhney and Nambisan, 2007). Therefore, the importance of network access is not new. Still, the experts gave a detailed understanding of network access. 80% of the experts addressed the importance of network aim orientation that influences network access. They outlined additionally, that certain agents can influence the access and aim of network platforms. 70% of the experts supported the view that a core of network agents shape network relations or try to actively influence them. The other three consulted experts were based in a strategic governmental position and stated that they could not contribute to this

phenomenon. The core group tries to shape different relations that also influence, if the platform is open or closed, the aim followed and the network type, being an innovation network or a production network for example. The network core tries to influence the relationships by the knowledge they share. They are often in the centre of developments for a long time and have a major role in network platform development. This interdependencies are shown by reciprocal arrows in **Figure 7.7**.

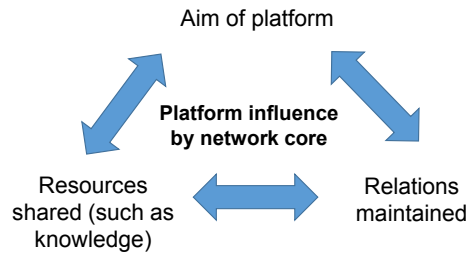


Figure 7.7: Network core and platform influence

Summarising the above, findings show that most experts agreed on network elements that are known in literature but gave additional insights. Here, it is important to note that the main statements were summarised inductively and findings do relate to elements of the conceptual model because of their meaning and not because it was explicitly asked for. Overall, findings add to current literature that network structures can be consciously exploited to share knowledge, friendship ties need to be differed from social ties as they not foster business development, and a network core influences dynamics in networks.

Category	Subcategory	Main statements	Number of experts	Number of nominations
Network structures	Network structure as platform of interaction	Network is a platform [similar as BE] and basis for cooperation and project work.	10	16
	Network structures	Network structures are determined by network agents that build up relations, being more formal or informal. Mutual aims determine what type of agents are in the network and what network type [this also influences openness] develops. Aims determined by founders influencing degree of formalisation.	10	15
	Access to network	Network access is determining how open and how closed a network is [can be determined by governmental requirements] Open networks enable broad knowledge, new subjects and diversity. Specific knowledge is shared in closed networks. Aim [broad, niche] of network defines access and structure and can change during development. Certain actors can influence access of network platforms.	10	14

Category	Subcategory	Main statements	Number of experts	Number of nominations
	Network aim	Aim of network determines network type, access, interaction and to a certain extend formality and informality. Networks can have economic or non-economic aim orientation, economic and strategic networks more close and selective on network members, change of aim can change structures.	8	13
	Network core of certain agents	There is always a long-standing network core of certain active agents that affect dynamics and developments in network by actively serving as information or knowledge platform while influencing network relationships and aims.	7	7
	Formal/ informal relations	Trust can substitute formal structures. Certain formality is always necessary to define network border and access. Very strong ties are economic ties or friendship ties, friendships are very seldom in business networks. Friendship does not foster business. Informal structures can be very strong as trust led and therefore can be more open. Type of relations very much influence KS.	5	7

Table 7.2: Network structures and their elements

Constitution of network success

To understand why agents engage in networks, experts were asked what constitutes network success.

Table 7.3 states the most often mentioned attributes of network success by the consulted experts.

Results show that the network aim reach is considered to be the most important factor for network success, 80% of the experts agreed on. This was already mentioned in **Table 7.2** as being the main element that keeps network relations together. Interestingly, experts did not mention network productivity, efficiency or quantified outcome, even though network outcome is one of the key areas of investigation in network research (Möller, Rajala and Svahn, 2005; Gulati, 1998).

Category	Successful is a network which	Number of nominations
Network success	establishes and achieves an agreed common aim	8
	creates a network of diverse business interest	7
	enables mutual interaction	6
	engages people that foster exchange and remain for long time	5
	creates win-win among members	4
	active cooperation/ mutual resource invest	4
	enables project work	4
	creates visibility of the network and the members in it	2
	enables a certain formality to secure long term success	2
	enhances (strategic) adaptability	2

Table 7.3: Experts definition of network success

The mutual aim can be seen as a fix point in BE or network platforms that enables agents to follow a

similar direction. They are bound together by a mutual aim or a shared vision (Iansiti and Levien, 2004a). Beside the common aim and the reach of that aim, combining diverse business interests and enhancing mutual interaction are considered to be very important for network success. Additionally, some experts also stated that, how exactly the aim is formulated is not important, the only relevant factor is that the network is able to reach its self-set aims and that the aim is based on mutuality. In order to ensure mutual aim reach, agents need to share resource such as knowledge for example. This exchange is based on mutual interaction and can create win-win situations. Furthermore, mutual interaction and mutual KS can enable agents to keep their position in the network (Ahuja and Carley, 1999). When network platforms are able to meet diverse business interests they can ensure a certain heterogeneity of resources (Barney, 1991) enhancing the motivation to interact and share resources among members (Helfat and Peteraf, 2003). This heterogeneity is also important for new knowledge input (McEvily and Zaheer, 1999; Van de Ven, 1986). Consequently, combining diverse business interest and enabling mutual interaction can indirectly serve the aim reach as being considered the most important success factor.

Recapitulating the above, networks are seen as structural entities or platforms, similar to BE, that centred on a shared vision or aim. This underlines existing theoretical knowledge and adds findings on BE and network structure interrelations. Additional to that, the importance of relation type, aim orientation and KS as possibility to influence network dynamics is not new, still experts enabled a more detailed understanding and added to current knowledge the importance of a network core containing of more than one agent.

Knowledge sharing in network structures

KS is considered as being an important binding element between agents (Iansiti and Levien, 2004a) and is essential to enable innovation in BE or network structures (Sawhney and Nambisan, 2007). Furthermore, KS can influence and is influenced by the structure of CR. **Table 7.4** shows results on KS in network structures and what factors were considered to be most important for KS. Network structures, agent role, the individual, network position and the need for innovation development were

mentioned to be essential elements for KS. 80% of experts agreed that agents use KS differently depending on their interest. 70% of experts were consistent in saying that open or closed network structures or network structures shaped by more informality or formality directly influence KS, referring to theory where network relations are seen as barriers and enablers of KS. Trust and proximity or control are depending on the formality or informality of the relation (Stacey, 1995; Granovetter, 1973) and enable or constrain KS (Grant, 1996a). The interest of agents is dependent on how much company and individual interest overlap, which is acknowledged by 60% of the experts. This adds to literature, as KS is very much dependent on ability (Grant, 1996b) and willingness (Caimo and Lomi, 2014) of the individual to share knowledge. Besides possible awards (Gupta and Govindarajan, 2000) trust can influence the willingness to share knowledge (Caimo and Lomi, 2014; Goh, 2002; Gupta and Govindarajan, 2000; Reagans and McEvily, 2003; Tortoriello, Reagans and McEvily, 2012). The results as stated in **Table 7.4** extend that understanding by showing that the willingness to share resources is determined by the interest of the individual overlap with company interest. This means agents engage differently in KS depending on interest intersection, which can be shaped by personal or strategic interest depending on the strategic interest of the company the individual agent works for.

As can be found in literature as well, more than 60% of the experts supported the view that innovation needs active KS balanced by the single agent. The balancing of knowledge also affects network structures and network platform openness. Agents only give away knowledge when they get strategically relevant knowledge back (Ahuja and Carley, 1999). Such as for example knowledge that could serve for innovative ideas (Van de Ven, 1986).

The network position of a network agent influences as well how the agent can and wants to share knowledge, a statement verified by 50% of the experts. Centrality as one possible network position can enable network governance and KS (Jones, Hesterly and Borgatti, 1997; Ahuja, 2000; Rowley, Behrens and Krackhardt, 2000). The degree of centrality differs by network relations the agent is in and his ability to influence other network agents. Additionally, 50% of the experts were coherent in

saying that centrality can be defined in different ways. Being as a certain economic centrality, administrative centrality or KS centrality as stated in the last row of **Table 7.4**. Consequently, centrality depends on the agent and his relations being based on a certain economic influence, organisational influence or influence on KS. Summarising this, agents in a central economic position do not need to be in administrative or KS central positions. As can be seen in **Table 7.4** no statement was made on what agents could be in central positions of CR.

Category	Subcategory: knowledge sharing and	Main statements	Number of experts	Number of nominations
Knowledge sharing	agent role	Agents use knowledge sharing and knowledge shared differently depending on their interest. Type of knowledge shared depends on type of agent in network. Companies try to balance knowledge they get and knowledge they share.	8	8
	network structures	More open or closed network structures or network structures shaped by more informality or formality directly influence knowledge sharing. Closed structures enable the sharing of specialised knowledge through formal relations or relations build on trust.	7	9
	the individual	Individual interest and position in company as well as their behaviour in network are key factors for knowledge sharing. Personal identification with company and network aim very much influences willingness to share knowledge.	6	8
	the need for innovation	Innovation development requires resources invest which needs to be balanced as it can become expensive. The need for new knowledge and innovative ideas can determine network openness.	6	5
	network position	Network position can influence knowledge shared. It depends what network agent (interest) is in central network position and if the central position is a position shaped by formal or informal relations.	5	5
		There is a difference in network central positions as centrality of certain agents can result out of economic influence, out of interaction based on for example knowledge or information exchange or out of an administrative function.	5	5

Table 7.4: Knowledge sharing in network structures

Dynamics in network structures

Network relations can be influenced by agent behaviour but also by industry developments (Rong et al., 2015). **Table 7.5** shows how consulted experts explain the influence of industry developments on network relations. 80% of the expert addressed were coherent in saying that network relations evolve around a certain aim that can create a force field. The personal or strategic interest into network subject or aim binds network partners together. This is not new, when CR follow a mutual strategic

aim they can group together as a network to reach that aim (Gulati, Nohria and Zaheer, 2000). Another 80% (supported by 15 nominations) of the consulted experts supported the view that industry specifics influence the relations between agents, and therefore influence network development, network culture and the strategic interest of the organisation. Competitive industries create a stronger strategic interest of the individual firm and consequently strategically shape intercompany relations. In other words, as the industry develops, networks develop. Each network has an associated culture being affected by network relations being formal and informal as well as closely embedded or loosely structured. The dynamics are also determined by the strategic interests of the individual organisation, being for example a Keystone organisation, and the strategic interest of the platform of interaction. Very competitive industries often develop a competitive force field where relations are shaped by different interaction than in force fields that are not shaped by strong competition. Adner and Kapoor (2010) outline these challenges on industry level and its influence on networks and organisations as well. Nevertheless, the addressed experts developed the term of an economic force field to explain aim and relationship development, which provides a new approach on understanding platform development. 60% of the experts mentioned that independent networks have different dynamics when they are governed by a dedicated network management. This is supported by the explanation that an economic force field can develop out of governmental requirements in a top down development or by bottom up dynamics (Lorenzoni and Baden-Fuller, 1995; De Wit and Meyer, 2010; Choi, Dooley and Rungtusanatham, 2001) influenced by a big player with a certain economic power. Dependencies in these distinctly developed network structures are different as well as the influence of the triggering agent. In governmental led networks dedicated network manager occupy administrative functions. Due to the missing strategic interest in governance organisations, these persons are often not triggering agents. Company and personal interest also need to overlap in order to have an active agent in the network, corresponding to the findings outlined above. Willingness and ability of the individual are important when advice relations lose their authority outside of the organisation the individual acts in (Arya and Lin, 2007; Caimo and Lomi, 2014; Zander and Kogut, 1995).

In summary, network relations evolve around a certain economic force field. Network development can be pushed by governmental or company created economic force fields. This force field is also influenced by aim and vision developments, building a frame for network structures. Network development is influenced by certain agents, triggering agents, which are led by overlapping personal and business interests.

Category	subcategory: network development influenced by	Main statements	Number of experts	Number of nomi- nations
Network development	aim	Network relations evolve around a certain aim that can create a force field. This can be an economic aim. Personal or strategic interest into network subject binds network partners together.	8	10
		Network aim determines network type, determines structures, determines actors involved, network development is path dependent.	5	5
	industry challenges	How the industry is build up influences the relations between agents and therefore influence network development, network culture and the strategic interest of the organisation. Competitive industries create a stronger strategic interest of individual firms and consequently strategically shape intercompany relations.	8	15
	bottom up development	Independent networks have different dynamics than networks that are governed by a dedicated network management.	6	10
		Network structures can evolve out of an economic strength field, such as a new development. When this strength field changes the whole network can change.	5	7
	top down development	Network structures can be developed by a government in order to strengthen an industry or region around a possible economic force field.	5	6
	influencing person	Can be a triggering person or a dedicated network manager. The network manager can be an influential person that manages the network but he does not trigger developments. It is important to have more than one person that actively triggers network development. In order to have a triggering person in the network strategic company interests and personal interest need to overlap.	6	6

Table 7.5: Influencing elements of network development

The graph displayed below in **Figure 7.8** summarises the major findings of the two subcategories of BE demarcation, network structures and network dynamics in BEs by displaying the outlined interrelations and connects them to the conceptual model (**Figure 2.8 and 2.9**) in chapter two. Connections outlined show how findings contribute to the comprehension of CR and their agents. In order to improve the interpretation of **Figure 7.8**, main elements are numbered and discussed subsequently in the following. Number one shows that a core group of network agents tries to influence the development of a platform of interaction. The platform can be shaped by different

interactions influencing the formality or informality of the relation (marked with number two). Furthermore, how relationships are developing is also influenced by industry specifics, for example the degree of competition. The platforms of interaction are formed around a certain aim or vision (number three) that is an important element to centre agents around platforms of interactions on different levels. Depending on the platform of interaction, a different degree of formality is possible. Cooperations have a higher degree of formality as often based on contract, whereas relations on BE level do not have to be shaped by direct interaction. Therefore, the room for knowledge exchange, as well as level of knowledge detail as well as platform governance mechanisms change (numbered as four and five).

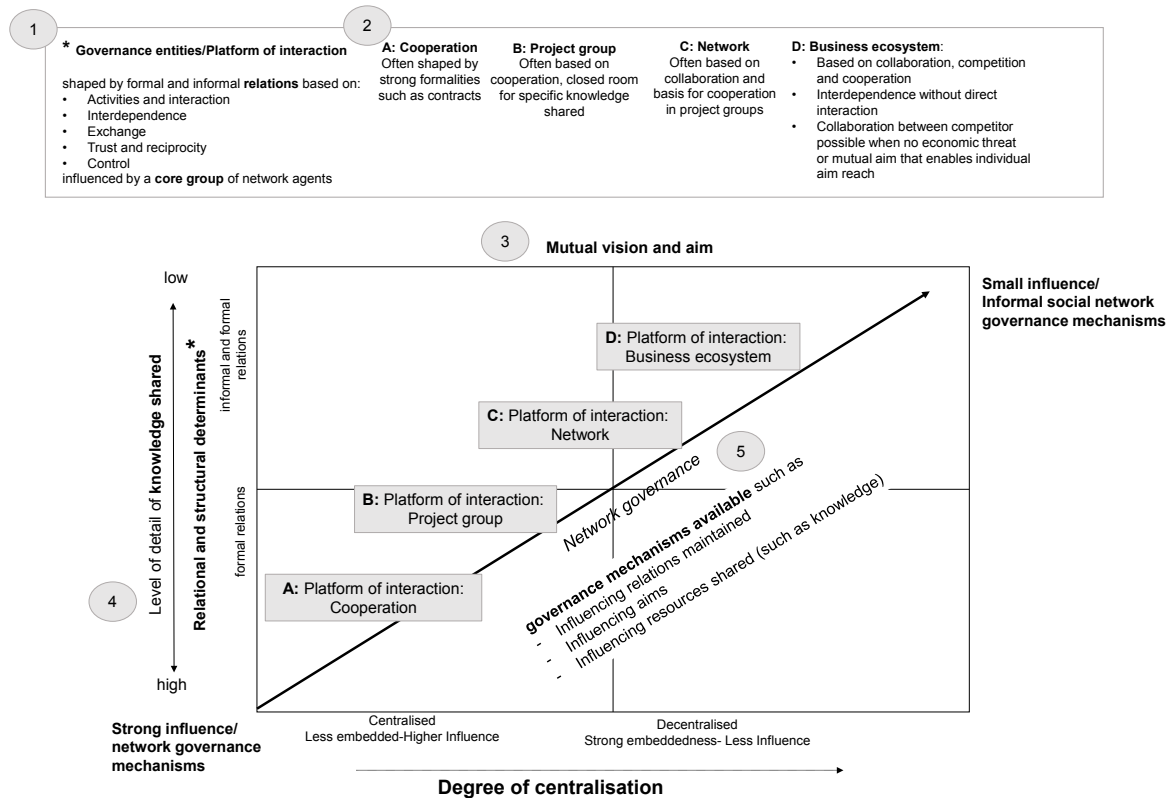


Figure 7.8: Platforms, knowledge sharing and mutual vision related to conceptual model

Although, theoretical considerations on platform development relate also to governance ability and industry influence (Moore, 1998; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012), the combination of network structures and BE structures, KS, different types and levels of

platforms of interactions around a certain aim or vision, as outlined in the findings section, is a new approach to understand ecosystem structures. Overall, findings support the conceptual model introduced in chapter two, where network environment, governance mechanisms and knowledge sharing are outlined (**Figure 2.8-2.9**) and even extend it by adding important details relating to the interdependencies of BEs and networks, the central role of the mutual aim and interdependency among agents.

Agents in network structures

The last result category in this section concentrates on agents in network structures. As described in **Table 7.5**, personal and strategic interests of agents influence agent behaviour in network relations. In addition, company and individual interests belong to each other. **Table 7.6** displays the elements that influence certain agent roles. Individual and company level are equally important for agent behaviour in network relations corresponding to Moore's (1996) view on BE species. 80% of the experts consulted suggested that individual and company level belong to each other in order to describe a network agent. Both, company or individual constraints can hinder or enable action in CR. A direct connection between head and employee is advantageous for an agent to be active in CR (supported by 15 nominations). Furthermore, company and individual characteristics influence behaviour of agents and their fulfilment of a certain role. Additionally, 70% of the addressed experts mentioned that the position of the individual within the company, and the position of the individual and the company in network relations, plays a vital role for their ability to fulfil an agent role. Personal and strategic interests are seen to be reasons to fulfil an agent role. 60% of the experts were coherent in saying that there are certain roles existent in CR.

Five distinct roles were described by 60% of the experts. They named trigger, creative, follower, neutral and egoist as possible roles agents can play. The roles introduced correspond to roles described in theory. Iansiti and Levien (2004a) also described four core roles in BE structures that were then adapted by other BE research (Scaringella and Radziwon, 2017). Additional to Iansiti and Levien's (2004a), a fifth role was mentioned, being the neutral role. In order to fulfil these roles, 60% of the

experts agreed that companies need to be able to invest resources necessary and follow a certain strategic or personal interest.

Category	Subcategory	Main statements	Number of experts	Number of nominations
Roles in networks	Two level perspective on agent roles	Organisation and person belong together in network as individual person acts for company in network and needs to follow company interest. Both level important to characterise agent. Resource invest and company culture influence persons acting for company in network.	8	9
		Individual and company level: A direct connection between head and employee is advantageous. Every actor has a personal interest and the company has a strategic interest, network aims need to fit to either personal or company interest.	8	15
		Personality and position in company is important for playing certain roles in networks. Companies that are well connected to their network representative are better able to take decisions.	7	11
	Reasons to fulfil role	Personal and strategic interests are reasons to fulfil agent role. Network can help to realise strategic or personal interest and to take decisions.	7	7
	Existence of certain roles	Similar agents influence distinct structures and often engage in a core group. Five different roles could be identified (trigger, creative, follower, neutral, egoist). Network founders and agents that understand development of network in the future are often very influential.	6	7
	Circumstances that enable agent roles in networks	Companies need to be able to invest resources to fulfil agent roles, the willingness to invest resources also depends on personality of agent, his strategic interest, and how his interests are met.	6	6

Table 7.6: Elements that influence agent roles

Summarising these findings in **Table 7.6**, they contribute to literature by emphasising the role of the individual and the company to describe an agent role, the importance of personal and strategic interest and a direct connection between head and employee to fulfil agent role. Additionally, the existence of certain roles was confirmed and extended by the neutral role.

Characteristics of agents

Table 7.7 lists all agent roles and their characteristics as they have been outlined by the experts consulted. **Table 7.7** displays all main statements made on the very role introduced. Here, all statements are listed, although only a small number of experts supported them. This was done to enable a holistic view on how the consulted experts see the roles and how they experienced them in practise. Again, statements made by more than 50% of the experts are discussed. One expert, not in an active position and not in contact with network agents, did not contribute.

The trigger role was mentioned by 90% of the consulted experts and corresponds very much to the Keystone role introduced by Iansiti and Levien (2004a). As every expert addressed experienced a close contact to the triggering role, a high number of experts confirmed his existence. Here again, strategic and personal interest are stated to be key to fulfil the role. Also, 50% of the consulted experts stated that a triggering role does not need to be in the centre of economic activity which contrasts with BE theory, where Keystones are often stated to be the central player (Isckia, 2009). 50% of the experts agreed that a creative role such as the idea giver and an egoist exist. These two roles can be related to the Niche player and the Dominator role (Iansiti and Levien, 2004a). The additional role introduced, the neutral role, is explained to be an important role by 50% of the addressed experts as it secures a certain neutrality due to the lack of economic interest. This agent is often a governmental agent, for example employed by a local authority. The roles described in **Table 7.7** will enable to better select the Keystone in case study research.

Category	Subcategory: Roles introduced by Experts	Main Statements	Number of experts	Number of nominations
Agent roles	trigger role	Trigger can see the bigger picture, the overall system (such as how to reach innovation).	9	11
		Companies start to trigger a project when they are strategically interested. Interest can be shaped by personal and strategic interest.	6	8
		Triggering person/company does not necessarily occupy an economic central network position.	5	7
		Network trigger can be network leader as well (influencing network dynamics).	5	5
		Although, triggering person/company is well connected inside and outside the network a contact core for its own interest can be built. But that does not mean that triggering person/company automatically well linked with everyone.	4	5
		Triggering persons need to have the support within their organisation.	4	4
		Triggering persons build a network core that is shaped by direct contact and frequent interaction.	4	4
		Triggers knowledge sharing, does not create much knowledge himself but can be creative as well. Influences others to contribute knowledge.	3	5
		Triggering person not just matches ideas but relates them to network development and aim reach, is open to changes and can adjust. They act as multipliers that try to move things, important to connect with them.	3	4
		Trigger agents often address other network members on a personal basis (listen to problems).	3	3
	neutral role	Governmental organisations are important for many network members. They secure a certain neutrality as they don't have an economic interest.	5	9
		Network management tries to be a trigger when no one else is interested in project. Often lacks (strategic) interest and contacts.	4	5
		Network management often introduced when governmentally supported network.	4	4
	reliable/ quiet/ follower role	Reliable agents listen to problems and are there to realise ideas.	3	4
		Quiet actors have a lot of know-how that is hard to get.	2	2
		Followers exist that follow mainstream.	1	1
		There are inactive members that just want contacts.	2	2

Category	Subcategory: Roles introduced by Experts	Main Statements	Number of experts	Number of nominations
	idea giver	They are Niche player that wait to bring in their knowledge, they generate ideas, triggering person distribute them.	5	5
		Idea givers know quite well what is possible in network with existing partners.	3	4
		Ideas raised by idea givers are often well thought through.	2	2
	egoist	Often economically dominant and influences economic relations that exists between companies in network.	5	6
		Big companies can be more active on innovation subjects as they have the resources.	4	4
		Big companies need small companies to realise ideas, they can hinder innovation development in networks as small companies are afraid that they catch their know-how. They are needed for implementation of ideas due to possible resource invest.	3	4

Table 7.7: Network agents and their characteristics

Figure 7.9 considers findings mentioned above and summarises them from an agent perspective into an onion model, as used by Saunders, Lewis and Thornhill (2012) adapted to new context. The individual person and the company acting in CR follow a certain interest (number one) that enables better interaction the more the interest overlaps. Due to this interest, a certain aim reach on different levels of interaction is important (number two). This aim also influences the activity of the agent on project group, network or BE level. The less direct interaction the harder for the agent to influence his personal or strategic aim reach. A certain position, such centrality and collaboration (number three) with a network core of same or similar interest enables the agent to influence the CR he acts in. Depending on the strategic aims a certain agent role is followed such as a triggering, egoist or creative role (number four). This corresponds especially to findings of **Table 7.6** displaying that personal and strategic interests play a major role for the ability of the agent to act in network structures.

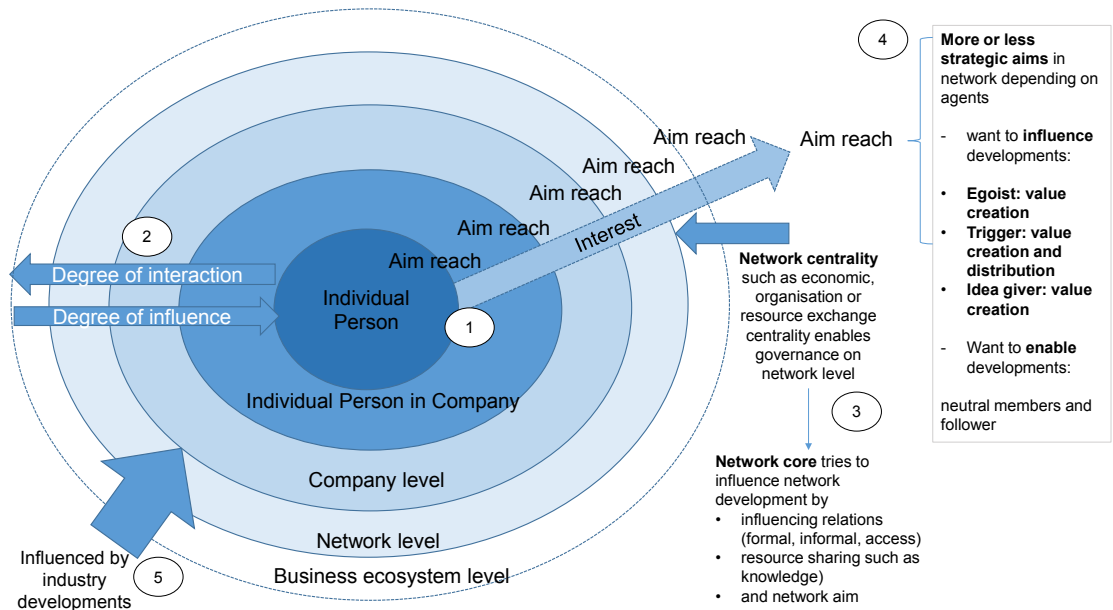


Figure 7.9: Interdependencies described by Experts

Overall, the findings stated above confirm what has been expected and described in the conceptual model introduced in chapter two. The findings of the expert interviews enable a more detailed understanding of interdependencies and connections explained between industry environments, BE and network structures and the role of agents in certain network positions.

The findings confirm the importance of particular roles, outline their characteristics and give a detailed understanding of BE and network structures as different levels of interactions on distinct platforms. Additional to that, governance mechanisms based on network relations, resources shared, such as knowledge, and the importance of strategic and personal aims, are outlined. The experts emphasised the role of the individual and the organisation for investigating network agents. Furthermore, they outlined the industrial influence on BE and network structures. Due to these findings a multilevel perspective and the case selection criteria, as chosen in chapter four in **Figure 4.5 and 4.6**, are considered to be appropriate.

7.3 Case study: display of major findings

7.3.1 Introduction

This chapter provides findings of the case study analysis. An overview of main case specifics are displayed in **Appendix F**. As the case studies were conducted, a variety of different methods were used. Consequently, results displayed here were derived from a very comprehensive data set. As outlined in the data analysis chapter, a high amount of words resulted from observations, interviews and secondary data. In this chapter these results explored will be put into context of the overall research and current literature. The introduction section addressed how data was coded and summarised to main statements used. For the case study analysis these statements were mainly allocated to certain characteristics and actions related to the Keystone agent in order to answer the research questions stated in chapter three. During data collection and analysis it was explored that observation and interviews mainly revealed characteristics and actions of the Keystone agent. Other network agents tend to explain how they would characterise the Keystone agent. The Keystone individual also delivered a lot of explanation why he would do things in a certain way and often referred to company characteristics or personal characteristics to justify his actions. Observations of network meetings underlined the statements of the Keystone and other agents, being able to observe not only actions that influenced the behaviour of all agents, but also repeating behaviour of the Keystone agent that characterised him as a person or as the employee of the company he was engaging for.

Consequently, characteristics and actions were the essence that could be extracted from all data analysed. As introduced in the literature review, characteristics describe something or someone, and actions are the foundation of individual behaviour, which cannot be separated from characteristics as both are interrelated and develop out of each other (Schatzki, 2011; Mintzberg and Waters, 1985). Therefore, characteristics and actions will be used to describe certain aspects of the Keystone role. Rather than separating them, they will support each other as many characteristics showed themselves

through repetitive behaviour of the Keystone agent. How exactly both aspects are used to support each other is outlined in the respective section. As discussed in chapter six, three Keystone companies and five Keystone individuals were identified by their characteristics and actions. For the in-depth analysis in this chapter only Person B/ Company B; Person C/ Company C of **Case I** and Person A/Company A of **Case II** were considered as they followed a strategic interest and provided the access to individual and company level.

This section mainly concentrates on outlining Keystone similarities in order to answer **RQ1**. **RQ2** will be answered in the second subsection and the third subsection answers **RQ3** on differences between Keystones. All three subsections are built on a cross-case analysis (Eisenhardt and Graebner, 2007). **Figure 7.10** shows how the research questions relate to the section structure.

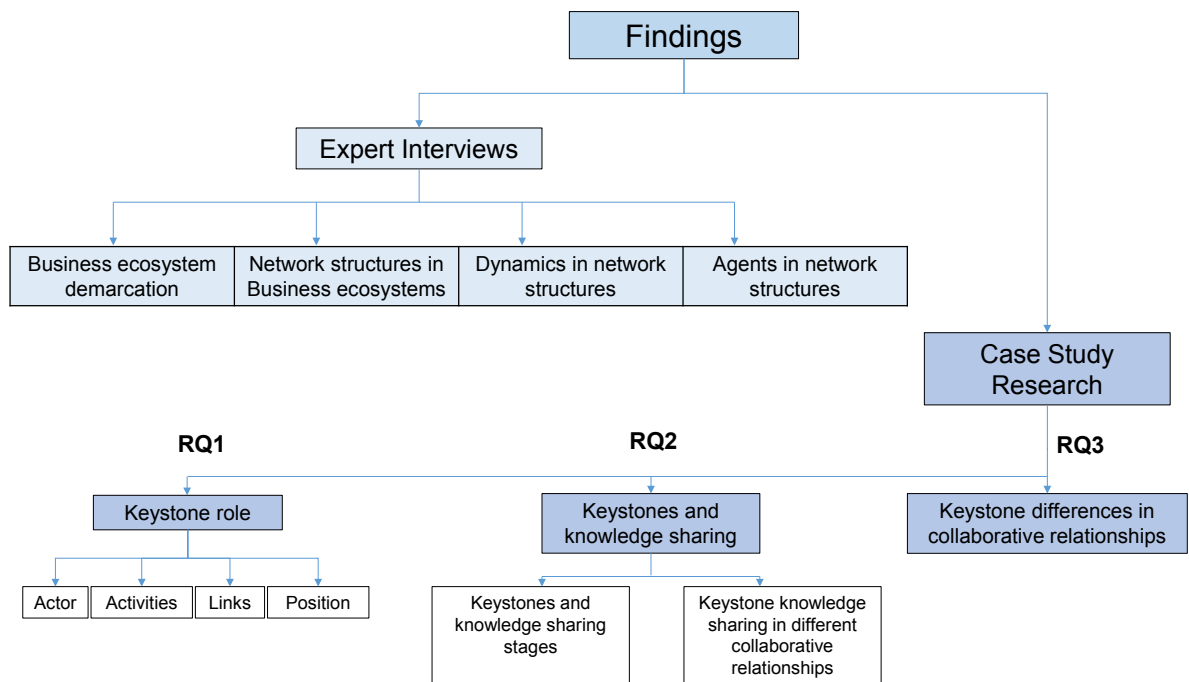


Figure 7.10: Findings chapter structure related to research questions

7.3.2 Data allocation

To allocate characteristics and actions into a logical order and in order to describe the Keystone role as comprehensive as possible, Adner's (2017) dimensions were used. He introduced four elements for analysing a BE. His dimensions highlight elements to analyse network structures and are used in

this work to understand the Keystone role in detail and analyse it from a holistic perspective (**Figure 7.1**). So far, no structured analysis of the Keystone role is available in literature. As already displayed in the literature review section in **Table 2.3 and Table 2.5**.

As shown in the literature review section, only a limited number of Keystone literature exists. Works are mainly repeating Iansiti and Levien's (2004a) Keystone description. Furthermore, the term role is still blurred and not provided with a concept that could define the role. Even though Adner's (2017) dimensions refer to a structured BE analysis, they provide a good starting for understanding the Keystone role from a holistic perspective.

Figure 7.11 displays how Adner's (2017) model is used for the description of the Keystone role. The box displayed in the middle of the diagram lists Adner's definitions on actors, activities, links and positions (Adner, 2017). For this work, actors are characterised by characteristics that were stated or observed in relation to the Keystone agent, supported by the activities that underline the characteristics found. Activities or actions were analysed to understand Keystone strategy supported by Keystone characteristics. Links and positions refer to links and positions of the Keystone agent and not the whole ecosystem. Whereas actor characteristics and strategic actions were mainly explored by observation, interviews and secondary data, the position of the Keystone agent and his links were derived by the network mapping method. Very often other network agents mentioned aspects in their interviews that supported the findings of the network mapping and secondary data. This enabled additional verification. All statements and observations used, being the description of the actor, agent strategic activities, agent links and agent position, will jointly describe the Keystone role and answer **RQ1**.

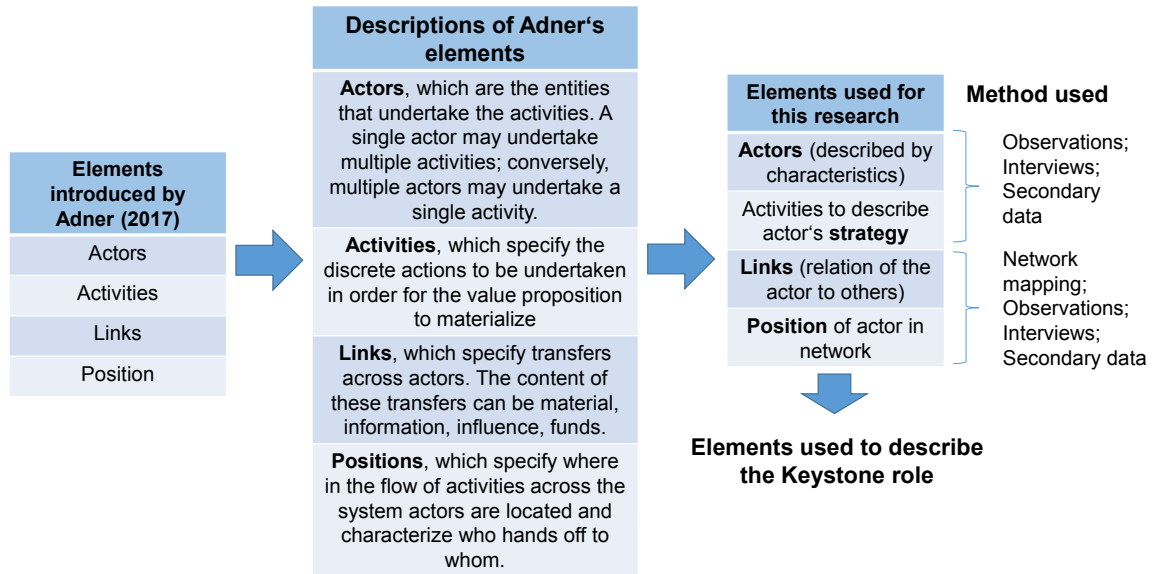


Figure 7.11: Detailed model for Keystone role analysis

As the Keystone agent can refer to the individual and the organisation (Moore, 1996), the study was conducted to collect data referring to the individual and the organisational level. Furthermore, all actions and characteristics were allocated to distinct levels of interaction, being the organisational, the network and the BE level. As the entry point of data collection was the network, the Keystone individual was investigated first. After having identified the Keystone person as described in the data analysis chapter, observations and statements of other network agents enabled a first understanding of Keystone characteristics and actions on individual and on network level. By asking other Keystone company employees, characteristics and actions of the Keystone individual on company level were allocated. The BE was observed through some open network meetings and was mentioned very frequently by the Keystone individual and other agent members. While summarising all characteristics and actions explored, they were allocated on distinct levels of interaction. Additionally, the Keystone company was investigated in a similar way except that observations could not be executed due to restricted access to the companies. Here, after Keystone individual identification, other Keystone organisation employees and other network agents were interviewed in regards to the Keystone company. Secondary data was used to complete analysis. **Figure 7.12** gives an overview of the described multilevel analysis.

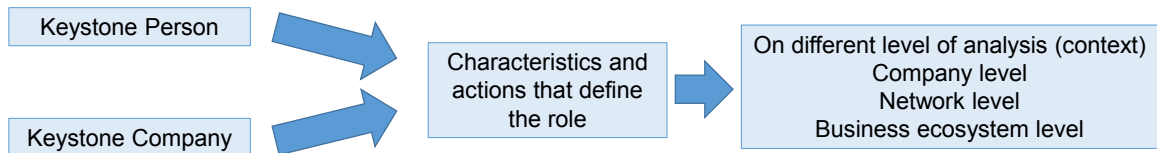


Figure 7.12: Multilevel analysis of Keystone characteristics and actions

Additionally, all characteristics and actions described to understand the Keystone role were allocated to De Wit's and Meyer's (2010) dimensions to analyse strategy. The dimensions used help to address a complex issue in a structured way. The dimensions were used as displayed in **Figure 7.13**.

Dimension	Allocation by DeWitt and Meyer (2010)	Allocation in this work	Dimensions in this work
Structure	Only implicitly mentioned	All characteristics and actions referring to structural or relational elements	Relational Dimension (Types of Relationship maintained) Structural Dimension (Set structures, agent connection, position)
Process	Strategic Thinking Strategy Formation Strategic change	All characteristics and actions referring to processual elements	Strategy Formation Strategic Change Resource Sharing Knowledge Sharing
Content	Content of business, corporate or network level strategy (being competitive e.g.)	All characteristics and actions referring to strategic content	Innovation Strategic Aim
Context	Industry context Organisational context	Characteristics and actions allocated to context the keystone agent acts in	Organisation level Network level Business ecosystem level

Figure 7.13: Dimensions for a structured data display

In order to be able to holistically describe the Keystone role and answer **RQ1**, the following subsections are referring to the elements actor, strategy, links and position related to Adner (2017), while the data collected is displayed in relation to structural, processual, contextual and content dimensions related to De Wit and Meyer (2010). Consequently, the latter structures the data, the first links data to theory.

7.3.3 Keystone agent role

7.3.3.1 Agent characteristics

The following subsection introduces agent characteristics on individual and company level to describe the Keystone agent as BE actor. As outlined above, characteristics explored from distinct sources were allocated to main characteristics on different levels of interaction. Consequently, the following two tables show first individual Keystone characteristics on company, network and BE level, and second the Keystone company on all levels. Characteristics and actions are dependent on and support each other, as shown in **Tables 7.8** and **7.9** below. **Table 7.8** displays characteristics allocated to the Keystone individual. The characteristics outlined were related to the dimensions listed in **Figure 7.13**. Characteristics that could be found to be relevant for all three levels of interaction the Keystone agent acted in, are marked with a bold frame. Actions are additionally displayed to better understand the characteristics listed. Not all characteristics shown on one level of interaction were relevant for the other levels, which shows that the Keystone individual constantly adapted its behaviour and the characteristics needed to reach his aims.

“In order to reach my personal aim of diversification in the region, I have to take care of it, diversification needs to be triggered ... in the end every company follows a strategic aim in the network that needs to be reached ... we don’t want to pressure others but we want to bring them to work towards the same aim.”(CASE I/ B1)

This direct quotation from a Keystone of **Case I** underlines that a Keystone’s influential behavior, as well as certain actions and influencing characteristics, are shaped alongside the reach of personal and strategic aims the Keystone person and its company follow. This view is supported by Corsaro, Cantu and Tonisini (2012) explaining that actor goals determine not only his knowledge base, his capabilities and competencies, but consequently his ability to influence other network agents, interactions and knowledge flows.

As shown in **Table 7.8** a long list of Keystone individual characteristics were allocated. Every dimension introduced in **Figure 7.13** contains several characteristics, such as for example KS or strategy formation. In the following, the characteristics will be outlined by every dimension. After that, characteristics that were visible or described for all three levels of interaction are outlined further as being the characteristics mentioned and observed most often. They have an impact on all levels of interaction and are therefore considered to be very important for the Keystone agent description. Furthermore, differences between company, network and BE will be highlighted when they are valid for both cases.

Some characteristics were only expressed or shown on a certain level such as for example ‘awareness of formal relation (need for business realisation)’ on network level. Even though it could be suspected that a Keystone individual would have the awareness in general and not only related to the network level, the characteristics were strictly allocated to the respective levels of interaction as they were observed and mentioned in interviews.

In the following, individual characteristics are outlined and discussed first, followed by company characteristics. In order to conclude main characteristics that can be related to both, the company and the individual level are summarised and discussed in front of current literature describing the Keystone agent in the end of this subsection. Characteristics marked by a bold frame in **Tables 7.8** and **7.9** are characteristics that were shown or described on at least two levels of interaction and in both cases. These characteristics are similar to all three Keystones investigated. Characteristics that are shown to be different between Keystone agents in both cases will be discussed in order to answer RQ3.

Building on the result displayed in **Table 7.8** the following findings were derived.

Referring to the structural dimension based on relational and structural aspects, Keystone agents showed to be very collaborative as long as either their personal or the company interest were met. They are not only collaborative inside but also outside their organisation, acting very closely with a core of other Keystone agents triggering, or at least following, their aims. Keystone agents serve as a

contact hub by building informal and formal relations outside and inside their company to enable collaboration while following their aims. They strategically bridge to other networks and important contacts and serve actively as a contact hub for niche and big players to enable value creation among agents. Keystone individuals often address others on a personal level and build up social relations in order to connect agents with each other. They are an architect of relations trying to connect important agents to each other and build a network structure or architecture they can use themselves. Especially to the Dominator or big player the Keystone individual tries to hold an informal relation. Furthermore, the Keystone tries to position its company in the network to reduce dependency, being aware of dependencies on formal business relations that do exist or are needed for the future to ensure upcoming business. By actively building up direct connections in network and company to ensure the development of innovative subjects, the Keystone agent shows an awareness for structures necessary to enable innovation. By strategically using contacts in and outside company and network, an awareness is visible about how to use network relations to reach aims. The agent also actively ensures proximity to big and Niche players. Naturally, this proximity was characterised for the network and BE level. Keystones trying to influence network structures on network or BE level, rely very much on collaboration with a network core of very strong partnerships and the contacts provided by these partners.

As outlined in the process dimension relating to resource sharing and KS, the Keystone tries to trigger everyone to bring in his competencies. He triggers what every network agent can do best and tries to optimally use and combine existing resources of agents. He acts as a value creation trigger on all levels of interaction. As the Keystone individual is aware that not all kind of knowledge can be shared on all levels of interaction, he tries to build up network structures that enable different kind of KS. More closed structures, such as in project groups, enable specialised KS. More open platforms of interactions, as on network level, are better suitable for general knowledge. By connecting other agents and triggering their contributions, he acts as a knowledge hub and trigger. He also serves as a

trust builder for KS often mediating between agents. The less he is able to directly influence other network agents such as on BE level, the more he needs to use informal connections.

Referring to change processes, the Keystone agent shows the following specifics. Being aware about the economic dependency of his company on big players or governance institutions, as well as about BE developments, he tries to actively maintain his network position within the network he is most active in. He is aware of network dynamics and therefore actively tries to trigger network progression. By being very near to current developments, and by scanning actively for possible future developments, the Keystone individual is adaptable to changes. Furthermore, the Keystone seems to mainly operate from a network level, where he can actively address his aims. From there he is able to directly influence network agents towards the BE level, where he is an influencer and lobbyist of long term developments.

The strategy formation dimension resolves that the Keystone actively represents company interests in and outside of network. He knows about the Keystone company strategy, as he strategically communicates necessary parts of it to network agents, as well as informs himself about other agent strategies. He acts as a company representor and enhances innovation development in order to trigger company independency. As he engages actively and is in close interaction with relevant company head/employees, he also acts as a company strategy architect.

The content dimension shows that the Keystone is an innovation trigger, by enhancing innovative contributions of other network members and an innovation enabler by matching agents that could enable innovation development. He also tries to enable value creation within the network and the BE he acts in. He also develops innovative ideas himself but mainly on company level being inspired from network or BE contributions. He rather enhances value creation than creating value himself. In BEs he mainly tries to trigger certain developments, such as agent variety and the growth of an economic force field, triggering for innovation by introducing a joint aim or vision for agents involved. Referring to the development of strategic aims, he actively influences not only the company aim by being in constant exchange with company head or employees, he also influences the network aim of

the network he is very active in by communicating important developments to other network agents. Due to his engagement and connection to other network agents, he also balances the strategic interests by informing himself actively of others interests. This also helps him to constantly adjust his own interests.

All characteristics and actions of the Keystone individual are shown in a comprehensive way in **Table 7.8** below.

Dimension characteristics are related to		Keystone person		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
Structure	Relational								
	collaboration	collaborative (when personal and company aim is met)	cooperates with everyone in network that follows the same aim, interacts directly with decision makers	x	x	x	x	x	x
		collaborator with network core	collaborates closely with other agents following same aim			x	x	x	x
		not collaborative on traditional business (unit) subjects	does not foster collaboration on traditional business unit	x		x		x	
		interaction/ collaboration hub	tries to connect agents for collaboration			x	x		
		creator of open exchange culture	builds up a familiar network culture build on informal interaction	x	x		x		x
		open communicator	triggers open communication as key to network cohesion; enhances direct interaction		x		x		x
	contacts	contact hub	builds informal and formal relations outside company to enable collaboration, builds informal relations in company to reach aims	x	x	x	x	x	x
		contact broker	thinks strategically what contacts can be shared and what not and only shares contacts on a mutual basis when he gets something back			x			
		contact protector	protects contacts that relate to traditional business unit			x			
		bridge to other networks/ also inside company	pushes cross industry connection by addressing players of other industries to engage in network, seeks connection inside company	x	x	x	x	x	x
		bridge to political contacts	contacts actively political actors to influence developments in network and BE			x	x	x	x
		contact hub for Niche player and big player	balances Niche player and Dominator interest, addresses Niche player and Dominator for collaboration	x	x	x	x	x	x
	social relations	social relation hub/ relates with personalities	enhances direct interaction among agents by matching interests, enhances informal interaction	x	x	x	x	x	x
		social relation with company head	interacts on a personal basis with company head	x					
		social relation with other employees (for strategy execution)	interacts on a personal basis with employees		x				
		social relation with Dominator(s)	interacts on a personal basis with Dominator			x	x	x	x

Dimension characteristics are related to		Keystone person		Context						
				Company level		Network level		BE level		
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II	
		heterogeneity trigger of network agents	actively addresses cross industry agents for network				x	x	x	
	formal relations	awareness strong competition	tries to collaborate on BE level with agents that are not based in region to reduce dependency					x		
		awareness of interdependency among network agents due to business interests	tries to position company in network to reduce interdependency and communicates interdependency	x	x	x	x	x	x	
		awareness of formal relation (need for business realisation)	actively tries to build up formal relations for innovation implementation			x	x			
		reluctance on formalising	does not foster to follow any formal guidelines				x			
		Structural								
		relations architect	changes network structures by developing project groups or enhancing cooperation between agents, restructures company structures to reach strategic aims	x	x	x	x	x	x	
		user of network architecture	uses network structures to reach strategic aim, uses direct connection to company head and to employees	x	x	x	x	x	x	
		gatekeeper	decides who can participate to network			x				
		awareness of structures needed for innovation	builds up network structures for more innovative ideas, builds up network structures in company for innovation aim	x	x	x	x	x	x	
		network promoter/ representor in BE	tries to position network in BE, tries to raise awareness in company for BE development					x	x	
		awareness of intra-interorganisational network structures	addresses contacts by using existing network structures	x	x	x	x	x	x	
		proximity to big players and to Niche players	remains close to Niche player to enable value creation remains close to big player to enable innovation implementation, contacts business units needed			x	x	x	x	
		Resource sharing								
	Process	(Other than knowledge)	resource matcher/ value sharing hub	matches resources of agents			x	x		
			win creator amongst agents	tries to always find a mutual win			x	x		
			value creation trigger	tries to optimally use resources (expertise of agents)	x	x	x	x	x	x
			dependent on resource sharing	actively states that challenges faced can only be solved together			x	x		
			resource sharer to reach a strategic aim	engages for company in network to bring in relevant resources	x	x	x			
		Knowledge sharing								
			knowledge creator	samples areas in company that require knowledge creation	x	x				
			knowledge filter	filters knowledge for strategic relevance for his company			x			
			knowledge controller	control knowledge that he shares on network level			x			
	knowledge trigger		triggers everyone and tries to get information or knowledge for knowledge areas from agents	x	x	x	x	x	x	

Dimension characteristics are related to	Keystone person		Context					
			Company level		Network level		BE level	
	Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
	personal interest trigger for KS	tries to get agents to share knowledge by triggering personal interest		x		x		x
	knowledge merger	tries to merge/match knowledge by actively addressing agents to certain subjects	x	x				
	knowledge hub	Individual connects strategically necessary agents by frequent interaction	x	x	x	x	x	x
	knowledge hub architect	Individual tries to influence frequency of interaction and type of interaction among agents; often needs to trigger interaction			x	x		x
	information hub	shares information widely and unfiltered	x			x		
	knowledge protector	Individual protects knowledge that belongs to traditional business unit	x		x		x	
	knowledge broker	thinks strategically what knowledge can be shared and what not and only shares knowledge on a mutual basis when he gets something back			x			
	trust builder for KS	brings others to share innovative ideas by active trust building through mutual idea sharing	x	x	x	x	x	x
	user of advice relations for KS	when available individual uses advice relations to access and share knowledge (less available in structures that are less formal, less available in BE)	x		x			
	dependent on knowledge shared for strategy execution	actively seeks knowledge for innovative business (unit) ideas			x	x		
	social relation architect for KS	tries to enhance informal KS in network and BE			x	x	x	x
	aware that not every kind of knowledge shared on all level of interaction	knows and communicates that knowledge needs a certain room, general knowledge can be in open structures, specialised knowledge in more closed structures	x	x	x	x	x	x
	aware that open exchange culture key for KS	knows and communicates that only open communication can enhance KS and innovation				x		
	Change							
	influencer/ lobbyist of relation development	tried to influence the development of relations by actively connecting agents				x	x	x
	awareness company dependency on industry/ environmental changes	scans environment for future changes, discusses future changes in company	x		x	x	x	x
	awareness of dependency on big player/governance institution	tries to create independency from big or governmental players by introducing new business ideas	x	x	x	x	x	x
	awareness of industry changes and their impact in BE	tries to influence high impact institution (such as governments) or big players to enable value creation in BE			x	x	x	x
	awareness of dependency on network position	tries to keep position in network, raises understanding in company for resource invest in network in order to keep position	x		x	x	x	x
	awareness of network dynamics	observes network dynamics to see future developments			x	x	x	x
	trigger cross industry developments	pushes cross industry connection by addressing players of other industries to engage in network, seeks connection inside company					x	x

Dimension characteristics are related to		Keystone person		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
Content	Strategy formation	trigger network development	influences network developments by relationship building, KS to prepare for future developments			x	x	x	x
		trigger political support to enable change	contacts actively political actors to influence developments in network and BE					x	x
		adaptability to changes	scans changes in advance and tries to adapt to them	x	x	x	x	x	x
		openness to new developments (independent from economic situation)	is open to any new developments that could mean innovation				x		x
		company representor	actively represents company interests in network and outside of network	x	x	x	x	x	x
		awareness of company strategy	knows about company strategy and communicates necessary parts of company strategy for developments	x	x	x	x	x	x
		awareness other agent strategy	informs himself about other agent strategies	x	x	x	x	x	x
		independency trigger	triggers company independency by focussing on innovation development	x	x	x	x	x	x
		company strategy influencer	influences strategy making by closely communicating with relevant company head/employees	x	x	x	x	x	x
	Innovation	company strategy adapter	by communicating with company head/employees about network developments company strategy is adapted		x	x		x	
		strong strategic outward orientation	concentrates mainly on developments outside of company		x				
		network strategy architect	tries to influence network strategy by relationship building to reach personal/strategic company aim			x	x	x	x
		awareness innovation need to develop new business (unit)	strategically addresses agents to contribute knowledge	x	x	x	x	x	x
		innovative idea developer	Individual brings in innovative ideas in order to get innovative ideas back	x	x				x
		trust holder for innovative ideas	brings others to share innovative ideas by active trust building through mutual idea sharing		x		x		x
	Strategic aim	innovation trigger	triggers everyone and tries to get innovative ideas from agents	x	x	x	x	x	x
		innovation enabler/ matcher	matches agents that could develop innovation	x	x	x	x	x	x
		innovation hub	tries to connect agents for innovation development				x		x
		variety trigger	tries to bring in heterogenic partners				x	x	x
		awareness innovation risks	knows that Keystone company alone cannot implement innovative ideas but need Dominator for that					x	x
		economic force field trigger (for innovation)	triggers economic strength in industry by actively addressing agents that could deliver economic strength introduces a joint aim or vision for agents involved					x	x
		influencer company aim in network	constantly adapts to network activities to possibilities in networks	x	x	x	x	x	x

Dimension characteristics are related to		Keystone person		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
			keystone needs to also adapt company aim to some degree	x		x		x	
		influencer network and BE aim	tries to shape network aim by communicating important developments in environment to other network agents		x		x		x
		balancer of strategic interests	tries to balance network agents interests by informing himself actively			x	x	x	x
		aim keeper of strategic interests	tries to keep company aim on network level			x			
Legend: x: Verification in the Case; -: No verification in the Case									

Table 7.8: Characteristics and actions of the Keystone individual

Table 7.9 outlines characteristics and actions allocated to the Keystone company. The characteristics and actions were analysed in the same way as for the Keystone individual. Rather than referring to characteristics that result of a person's behaviour, characteristics and actions are listed that define the company behind the chart (Krackhardt and Hanson, 1993) such as for example formal and informal structures that shape the organisation and shape stability (Stacey, 1995). All findings are related to the same dimensions as **Table 7.8** above.

All characteristics and actions of the Keystone company are shown in a comprehensive way in **Table 7.9** below.

Dimension characteristics are related to		Keystone company		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
Structure	Relational								
		economic dependence of traditional business (unit) on big player	company holds a strong formal relationship with Dominator for traditional business unit	x		x		x	
		economic dependence on other network agents and on public governance financial support	company closely engages with network agents and governmental institutions to finance its business		x		x		x
		openness (collaboration) to new (business) ideas	collaborates with every agents that can offer knowledge needed	x	x	x	x	x	x
		open exchange culture in innovative business unit/ company	company enhances employee freedom in innovative business (unit), less hierarchies more open exchange	x	x				
		connected to all type of network agents including competitors	company connects with every agent that follows same interests also competitors			x	x	x	x
		contact hub for Niche player and big player	connects closely with niche and big player to enable and balance	x	x	x	x	x	x

Dimension characteristics are related to		Keystone company		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
			value creation and value implementation						
		direct connection between management board and Keystone individual and important employees	management board fosters direct interaction with keystone individual	x	x				
		familiar company or business unit culture	company enhances familiar company/business unit culture by enhancing personal interests	x	x				
		very informal company culture	Company does not provide many rules		x				
		openness to cooperation for new business (unit)	company actively seeks cooperation partners for new business unit	x	x	x	x	x	x
		social network in company important	enhances creativity of employees and network agents, enhances personal interest, internal exchange networks are fostered around innovative ideas	x	x				
		well connected to political institutions	company tries to connect to political player by inviting them to events			x	x	x	x
		well connected to Niche players and big players	Niche and big player connection is fostered as Keystone company not a specialist on all areas needed for innovation/ cannot implement			x	x	x	x
	Structural								
		proximity to important customers	company keeps geographical proximity to customers	x		x			
		proximity to big players and Niche players	company keeps close interaction to big players Niche players and considers value creation	x	x	x	x	x	x
		Strong formal network structures	builds up relations by fostering business interests			x		x	
		Strong informal network structures	builds up relations by fostering personal interests				x		x
		structural flexibility	adapts to changing environment by restructuring company structures	x	x	x	x	x	x
		strong hierarchical levels	company keeps strong hierarchical levels in traditional business units	x		x			
		lean structures	company enhances lean structures in innovative business (unit)	x	x				
		company structured as SME	even the bigger keystone company B keeps an SME structure by many small company entities scattered near to core customers	x	x				
		offers personal room for engagement	provides open job specification for employees	x	x				
		missing formalities	employees want more formality to stick to, feel like loosely connected actors		x				
	Process	Resource sharing							
		value creation trigger	tries to optimally use resources of employees		x	x	x	x	x
		open to additional resource invest in network	company invests resources without knowing return of investment	x	x	x	x	x	x
		open to invest resources without direct benefit	company invests resources without expecting direct benefits		x	x	x	x	x

Dimension characteristics are related to	Keystone company		Context					
	Characteristics	Actions	Company level		Network level		BE level	
			Case I	Case II	Case I	Case II	Case I	Case II
Knowledge sharing								
	dependent on complex know-how/technology development	tries to develop innovative technologies to create independency from big players	x		x		x	
	dependency on knowledge for new business development	tries to develop innovative technologies to keep network interesting or create new business ideas	x	x	x	x	x	
	dependency on knowledge to keep creativity as a selling preposition	tries to develop innovative technologies to keep network interesting		x		x		x
	KS trigger/ open to KS to gain new business knowledge	company enables employees to engage in network and share knowledge	x	x	x	x		x
	KS platform due to formal and informal contacts	shares knowledge and innovative ideas through formal and informal contacts when strategically relevant	x		x		x	
	KS platform due to informal contacts	shares knowledge and innovative ideas mainly through informal contacts to enhance interaction		x		x		x
Change								
	adaptability to changes	prepares company and network structures to be adjusted to future developments	x	x	x	x	x	x
	slow internal processes due to dependency on big player	company cannot react as fast as needed in traditional business unit to changing environment	x					
	independency trigger from big player	company enhances innovation that does not relate to big player business	x				x	
	awareness of changes company environment	company tries to react to changes in advance	x	x	x	x	x	x
	already preparing to future changes	company head wants to be prepared to react to future changes	x	x				
	awareness about industry situation	company head aware that industry needs to change	x					
	openness to new developments only as long as economic pressure not too high	company invests into new developments as long as economic wealth enables them to do so	x					
	shaper of future developments/ trigger of change	companies tries to shape future developments in network/industry by investing resources into network development	x	x	x	x	x	x
Strategy formation								
	employee flexibility and openness	employees decide within their business area, they are open to new developments	x	x	x	x		
	visionary management board/ head	management board/ head is keen to be ahead industry changes/ developments	x	x				
	direct connection between management board and Keystone individual/ Keystone individual and employees	keystone employees and management board/head foster direct interaction on new business (unit/area)	x	x	x	x	x	x
	creativity of company main selling preposition	company head communicates that formalities hinder creativity		x				
	clear strategic positioning	company communicates diversification strategy	x		x		x	

Dimension characteristics are related to		Keystone company		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
		no clear strategic positioning: missing formalities and clear strategic orientation make it hard to keep customers long term	company communicates no clear strategy but company head enhances diversification		x		x		x
		balancer of strategic interest	Company balances own strategic interests and agent interests to succeed with network engagement by constant adaption to developments	x	x	x	x	x	x
		clear company aim/vision existent	company aim/vision are communicated inside and outside the company	x	x	x	x	x	x
Content	Innovation								
		investor in new technologies (when industry stable)/	company communicates to invest into new technologies as long as resources available	x					
		innovation trigger	communicates interest in new innovation development	x	x	x	x	x	x
		proximity to customers enables innovation development	enhances proximity to customers to enable innovation implementation	x		x			
		shaper of new technologies	engagement in development of innovation force field or innovation platform enables company to be shaper of new technologies	x	x	x	x	x	x
		lack of innovation implementation	lacks learning mechanisms to applicate and integrate knowledge and combine it to innovative ideas	x	x	x	x	x	x
		awareness of innovation need to create independency	company enhances room for employee engagement to enable them to develop innovative ideas, be creative; company engages in the development of a force field for innovation	x	x	x	x	x	x
		innovation topic used to keep agents in network	Keystone communicates innovation as shared vison			x	x		
		innovation needed to keep network interesting	Keystone communicates innovation interest to keep network together			x	x		
	Strategic aim								
		shaper of the future	company communicates that it aims to a shaper of the future and does not want to react to developments only	x	x	x	x	x	x
		diversification of company products	company enhances product diversification	x	x			x	x
		awareness that homogeneous structures do not allow diversification	company fosters heterogeneous partnerships			x	x	x	x
	aims to reach relational independence (of new business unit in BE)	company constantly seeks for new partnerships	x	x	x	x	x	x	
	company head follow personal interest and company interest	company head follows personal interest and company interest	x	x					
		influencer network and BE aim	tries to shape network aim to serve strategic interests of company	x		x	x	x	x
Legend: x: Verification in the Case; -: No verification in the Case									

Table 7.9: Characteristics and actions of Keystone company

As displayed in the structural dimension of Table 7.9, the Keystone company is shaped by a collaborative and open internal exchange culture, at least in the business unit or business area the Keystone acts in. The company is connected to all type of network agents including competitors and serves as a contact hub when it comes down to connecting important agents for innovative subjects. This mainly results out of employee activity. Furthermore, employee contacts enable that the company is well connected to political institutions. Business relations maintained result into a good connection to Niche players and big players enabling in a certain proximity that is then used for innovative purposes. The Keystone company is open to collaboration and shaped by a structural flexibility. Even the bigger Company B/ **Case I** is structured as an SME as the company is scattered to small entities that are based all over the country to ensure proximity to customers.

The processual dimension shows, that Keystone companies invest resources in networks without expecting a direct benefit. They act as a value creation trigger always pushing other agents to contribute their resources to the networks as well. They are dependent on new knowledge for knowledge exploration in order to create innovation and develop new business ideas. They use formal or more informal network structures for knowledge access and sharing, depending on the structures they act in. As Keystone companies are aware of future changes, they show a certain adaptability. A visionary management board and employees want to be the shaper of the future. They are aware of strategic issues and connect strategic with personal interests. Keystone company employees can be flexible and open to new developments when they occur in the new business unit or area the Keystone company wants to be active in. The company wants to be a shaper of future developments. A direct connection between management board and Keystone individual, or important Keystone company employees, enables a direct interaction on the innovative subject aimed at. Keystone companies need to balance strategic interests in order to follow their aims and to influence actively network aims.

From a content perspective, this also implies that they need to be an innovation trigger, as their aim is to be a shaper of new technologies. All companies investigated show a high visionary orientation but a lack of innovation implementation. They are aware that they need innovation to create

independency but they also know that they cannot do it alone. This creates a certain paradox, as they aim to reach relational independence due to existing business relations but need other relations to follow innovative ideas.

When summarising the above, findings of Keystone agents on individual and company level can be summarised to the following overlapping characteristics and actions as displayed in **Table 7.10**.

Dimensions characteristics and actions related to		Keystone key characteristics	Keystone key actions
Structure	Relational aspects	Collaborative	open to collaboration
		Contact hub	connects agents
		Bridge to other networks/contacts	enhances interaction, influences interaction
		Social relation hub	Enhances social interaction inside and outside company
	Structural aspects	Relations architect	influences accessibility to relations or knowledge
		Proximity to Niche player& Big players	keeps proximity to important network and BE agents
Process	Resource sharing	Value creation trigger	triggers value creation by including relevant agents
	Knowledge sharing	Knowledge trigger	triggers knowledge to enhance specialist inclusion
		Knowledge hub	enables and matches knowledge and information flow
	Changes	Adaptability to changes	adapts company and network strategy to developments
		Change enabler	enables change in order to reach company strategy
	Strategy formation	Balancer of strategic interests	balances strategic interests by constant adaption
		Awareness of strategy requirements	aware of industry and company strategy requirements
Content	Innovation	Innovation idea developer/ shaper new technologies	engagement in development of innovation force field or innovation platform
		Innovation trigger	triggers everyone and tries to get innovative ideas from agents
	Strategic aim	Aim creator	influences aim development on all levels of interaction
		Network strategy/aim architect	tries to shape network aim to serve strategic interests of company

Table 7.10: Summarised characteristics of the Keystone agent

Table 7.10 shows the main characteristics found for Keystone individual and Keystone company in a summarised form. As displayed in Table 2.3 and 2.4 of the literature review section, Keystones were already described in literature by several different authors. Nevertheless, the works found did not focus on Keystone characteristics but did mainly outline their characteristics or attributes as a side line to BE or agent introduction. When considering the contributions listed in **Table 2.3** and **2.4**, the Keystone was mainly described as being a platform leader or orchestrator (Iansiti and Levien, 2004a; Sawhney and Nambisan, 2007) referring to his possible position in network or BE structures. Authors also mentioned activities the Keystone undertakes, which were clustered and numbered in **Table 2.4**.

Most activities mentioned by the authors are referring to platform provision or hub creation, structuring the ecosystem, enhancing interaction, enable niche and value creation, enable value sharing, keep technology standard up to date and maintain ecosystem health (Stead and Stead, 2013; Rong et al., 2013; Clarysse et al., 2014; Zahra and Nambisan, 2012; Iansiti and Levien, 2004a). These activities listed correspond to the activities found in both case studies. Especially the structural and relational aspects discovered in case study analysis overlap with the activities described in the literature review. Nevertheless, this case study analysis provides a higher level of detail on activities, added several new activities and allocated characteristics and actions to each other. For example, Keystones enhance interaction and create rules or standards of interaction (Clarysse et al., 2014). Findings revealed that they do so by maintaining and influencing important relations and by building up social relations to enable a direct contact to important agents. Additional to that, findings also contribute to theory by understanding Keystone characteristics and actions on individual and company level at the same time, as Keystones are considered to be both, individual and company (Moore, 1996). Furthermore, an engaged individual needs to have aligned interests with the company it engages for (Bosse and Phillips, 2016) which is also supported by the findings outlined above.

Even though, being collaborative and a contact hub is not a new part of the Keystone role (Clarysse et al., 2014; Zahra and Nambisan, 2012; Sawhney and Nambisan, 2007), a close collaboration between agents of a network core could be investigated. They are either Keystones or supporters of the Keystone forming a community of interaction, spanning organisational borders to enhance trust, KS and collaboration (Nonaka, 1994; Goh, 2002; Marabelli and Newell, 2012). Additional to that, Keystone characterised as a bridge (McEvily and Zaheer, 1999) to other networks and as a hub for social relations within BEs is an additional viewpoint to theory. The Keystone is a relation architect, providing proximity to Niche players and Dominators as confirmed by literature (Iansiti and Levien, 2004a; Stead and Stead, 2013) as well as the trigger for value creation (Kang and Downing, 2015; Bosch-Sijtsema and Bosch, 2015). Also, the Keystone is responsible for information and knowledge exchange as recognised by researchers (Iansiti and Levien, 2004a; Clarysse et al., 2014; Den Hartigh

and Van Asseldonk, 2004). Still, the degree to which Keystones are involved into KS and what KS activities undertaken remained blurred in former research. Case study findings reveal that Keystones are not only knowledge hubs but also knowledge triggers that engage others actively to bring in their knowledge by sharing knowledge themselves, enhancing mutuality. Additionally, they are willing to invest resources without getting direct benefits back as they see the long term goal they act towards. BE authors also described that Keystones are aware of the environment they act in and how this influences firm development (Zahra and Nambisan, 2012). This is supported by findings displayed in this study. Findings additionally add that Keystones are aim shapers of network and BE aims and want to be shaper of future developments. They are not only aware, they also want to actively influence developments to reach innovation aims. Keystones not only keep technology standards up to date (Isckia, 2009), they make sure that agents could bring in new technologies are engaged. Keystones therefore need to balance strategic interests, which contributes to the idea of balancing ecosystem health (Stead and Stead, 2013; Iansiti and Levien, 2004a). This ensures co-evolvement and the development of mutual goals (Moore, 1993; Moore, 1996; Sawhney and Nambisan, 2007; Zahra and Nambisan, 2012).

As **Table 2.4** literature review underlines, strategic considerations are only seldom subject of investigation in BE research but play a rather important role in the findings displayed in this section. For example why the Keystone needs to enable the sharing or balancing of knowledge. Case study findings show the need to develop a certain independency. Also, he needs to balance strategic interests in order to enhance interaction among agents and enable value sharing. The strategy the Keystone follows was not addressed by other authors in detail. Only Stead and Stead (2013) introduced the idea that Keystones follow a sustainable strategy in BEs. In this study, strategy and strategic aim play a major role, not only to outline company action but also because strategic considerations connect individual and company behaviour as both align their aims in order to follow a certain interest. Also, strategy explains why Keystone companies engage in BEs and keep the community healthy. Keystones and their strategies will be outlined in the next section of this chapter in more detail. The

awareness of the Keystone individual about company strategy, the influence on company and network aims, as well as the actions undertaken to fulfil strategy, add to the current understanding of the Keystone role as well.

Additional to Keystone strategy, KS is an important activity that is listed to a great extent in the findings above. As Keystones need to share their knowledge strategically (Isckia, 2009) and protect it from knowledge extraction of the Dominator (Stead and Stead, 2013), KS activities will be outlined in more detail in the subsection that addresses **RQ2**.

Also, Keystones are only able to succeed with their strategies by the relationships maintained, for example by keeping a certain proximity to Niche players or Dominators (Iansiti and Levien, 2004a). These aspects will be addressed in the subsection about links and positions revealed by network mapping. Beside Keystone individual and company characteristics and action, a lot of characteristics were mentioned and observed that related to the personality of the Keystone. As no description of a Keystone personality exist so far, but some personal attributes were found that overlapped strongly on the personal basis, these characteristics are shown below in **Table 7.11**. Except of being very intuitive without any interest informalities as shown for the Keystone in **Case II**, the characteristics were found to be surprisingly similar. Possibly a certain Keystone personality exists, which is not subject of further research in this work.

Personal characteristics Keystone person influenced by	characteristics*	Case I	Case II
Personality	Intuitive, not keen on formalising		x
	Empathy	x	x
	Convinced about own task in network	x	x
	Creativity	x	x
	Enthusiasm	x	x
	Ability to moderate and mediate	x	x
	Visionary	x	x
	Well informed	x	x
	Curiousness	x	x
	Patient	x	x
	Engaged	x	x
Legend: x: Verification in the Case; -: No verification in the Case			

Table 7.11: Characteristics of Keystone personality

7.3.3.2 Keystone strategy as part of the Keystone role

This subsection provides an overview on how Keystone individual and Keystone company activities overlap in order to enable Keystone strategy making. Here, characteristics and actions as introduced above, are allocated to each other by considering their strategic importance using again De Wit and Meyers (2010) dimensions. In BE literature Keystone strategy is always mentioned as an important aspect of the Keystone role (Iansiti and Levien, 2004a), therefore Keystone strategy needs to be understood in more detail to comprehend the Keystone role in-depth. Keystone strategy is often named interchangeably with value creation strategy (Scaringella and Radziwon, 2017) and is said to be conducted to keep the BE healthy (Mäkinen and Dedehayir, 2012). keystones are described as the agents in ecosystems that are offering platforms of interaction to increase ecosystem health, increase value sharing and creation (Iansiti and Levien, 2004a; Den Hartigh, Tol and Visscher, 2006). Authors also state that value creation and distribution is not done for altruistic reasons but is done for growing the own Keystone business with the ecosystem (Iansiti and Levien, 2004; Moore, 1993; Cusumano and Gawer, 2002; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012). Although authors already emphasised that a Keystone strategy is no altruistic strategy, the reasons why keystones act as ecosystem trigger or driver (Li and Garnsey, 2014) and what strategic aims the Keystone individual or the company want to reach remains blurred.

As shown above in Table 7.8 and 7.9, several characteristics and actions were allocated on individual and company level that highlighted the importance of Keystone strategy. Based on the findings displayed there, the following can be revealed referring to Keystone strategy. The Keystone individual is aware of the company strategy and considers it when pushing developments inside and outside the company, acting as company representor in network and BE structures. Furthermore, Keystone individuals are aware of other agent strategies and actively inform themselves about developments trying to trigger Keystone company independency. By always considering his own aims and the strategic aims of the company, the Keystone individual actively influences the network strategy as well. On BE level, his activity is reduced due to less frequency of interaction among

members. Because of well-developed contacts inside the company, the Keystone is also able to influence strategy making by closely communicating with relevant actors, such as company head or employees. Company strategy adaption is supported by this behaviour. The Keystone individual is not only an active influencer of company aims within the network and BE, he balances strategic interests of other agents to enable network and company co-evolution.

The Keystone company supports the Keystone individual with a high flexibility and openness for employee behaviour in the respective business area the company wants to innovate in. Employees can decide rather freely within their business unit to enable new developments. Beside the visionary management board, a direct connection between Keystone employees and Keystone head exists that enables close interaction. Not all Keystone companies provided a clear strategic positioning but all of them had a clear company aim or vision which was strongly related to innovation. The companies investigated stated that they wanted to be a shaper of the future rather than just an adapter. They aimed to push the diversification of company products and were aware that heterogeneity is needed to enable a certain diversification and development of new ideas. The aim to reach a certain independency of traditional business areas by creating new relations was one of the core motive for strategic action. Aim reach or aim orientation was only possible due to strongly interrelated company and personal interest of Keystone individual and company.

The findings outlined above contribute to the understanding that individual actions are important for strategy development (Jarzabkowski, 2002) and characteristics and actions of individuals shape strategy (Eisenhardt and Graebner, 2007). In order to ensure that characteristics and actions fit to the company, individual and company interests need to be aligned. Also, trust between the company and the individual is essential to enable this interest alignment (Bosse and Phillips, 2016; Hosmer, 1995), as an engagement of the individual is only possible when company and individual interests overlap. This has been outlined in the in the expert interview findings section as well. The mechanisms behind the interconnection of company and individual are for example part of agency theory and not subject of further investigation in this research. Still, it could be explored that in all Keystone companies an

interest alignment between company and individual interests took place on the basis of mutual trust, which enabled the engagement of the individual person. Aligning company interest to network and BE interest, as well as shaping aims, is a constant process and only possible when the Keystone individual engages actively in the network and enables co-evolution (Teece, 2007; Moore, 1993; Moore, 1996).

Additional to the aspects outlined above, **Table 7.12** shows that certain attributes of individual and company connection enable the ability of the Keystone individual to act as a Keystone for its company. This study found that Keystone individuals can be on every level of their company as they create their own social network within their company, acting across hierarchies (Kilduff and Brass, 2010). Here, the importance of overlapping interest of Keystone person and company is a major prerequisite for active engagement of the individual and for the strategic placement of the individual by the Keystone company in the respective network or BE. Furthermore, Keystones build their own community of practice (Nonaka, 1994; Goh, 2002; Brown and Duguid, 1991) to reach their aims by maintaining direct connections to relevant actors (Brass, 1984). Results from **Table 7.12** confirm already revealed findings in the expert sections.

Elements of individual and company connection	Attributes of individual and company connection	Case Study I	Case Study II
Position Keystone person in Keystone company	Keystone person can be on every hierarchical level of Keystone company. Important relations are maintained by Keystone person in Keystone company such as the direct contact to decision makers. Direct contacts are shaped by mutual aim, interest or vision	x	x
Connection between Keystone person and Keystone company	Keystone company and Keystone person are connected by overlapping interest. Keystone company places Keystone person in strategically relevant position (when strategic interest). (Strategic and personal) interests need to serve each other to ensure engagement	x	x
Position Keystone company in network	Position of Keystone company influenced by personal network and company network, due to informal and formal relations. Relations are often fostered due to a certain (strategic or personal) interest	x	x
Legend: x: Verification in the Case; -: No verification in the Case			

Table 7.12: Connection between Keystone person and Keystone company

Building on the findings how individual and company are connected to fulfil strategic actions and Keystone individual prerequisites to follow strategic actions, **Table 7.13** displays Keystone strategy. Here, actions undertaken are outlined, supported by Keystone characteristics, following a strategic

aim. All elements are again structured by strategy dimensions (De Wit and Meyer, 2010), in order to ensure a holistic perspective. For data display, Keystone individual actions and company actions were aligned and then summarised to a strategic aim reach. Only actions were considered undertaken on all level of interactions as shown above in **Table 7.8** and **7.9**. **Table 7.13** shows that individual and company actions build on and are dependent on each other. What is provided on company level results in certain actions on individual level and vice versa. Bold lines display what actions belong to each other and separations between the dimensions enable to allocate the actions to a certain aim reach. The first column displays the dimensions the characteristics and actions are related to. The following column list the described characteristics per strategy dimension. The next two columns concentrate on actions undertaken on individual level, complemented by a column that displays actions on company level. All actions in one dimension are summarised to a strategic aim. These aims are discussed further below.

characteristics related to strategy dimensions		context									
		relational level (individual)			company level (individual)			Company/ business unit level (company)			
		actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II	Strategic relevance
Relational and structural dimension	Company openness to cooperation for new business (unit)							collaborates with every agents that can offer knowledge needed	x	x	Builds relations inside and outside the company to overcome dependency in BE and industry. Remains close to big player to monitor development Includes specialists for value creation.
	collaborative (when personal and company aim is met)	cooperates with everyone in network that follows the same aim	x	x	interacts directly with decision makers	x	x				
	contact hub	builds informal and formal relations outside company to enable collaboration	x	x	builds informal relations in company to reach aims	x	x				
	bridge to other networks/ also inside company	pushes cross industry connection by addressing players of other industries or politics to engage in network	x	x	is well connected inside company	x	x				
	contact hub for Niche player and big player	balances Niche player and Dominator interest	x	x	addresses Niche player and Dominator for collaboration	x	x	connects closely with niche and big player to enable and balance value creation and value implementation	x	x	
	social relation hub/ relates with personalities	enhances direct interaction among agents by matching interests	x	x	enhances informal interaction	x	x				
	social network in company important							enhances creativity or employees and network agents	x	x	
	relations architect	changes network structures by developing project groups or enhancing	x	x	uses direct connection to company head and to employees	x	x				

characteristics related to strategy dimensions	context									
	relational level (individual)			company level (individual)			Company/ business unit level (company)			
	actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II	Strategic relevance
	cooperation between agents									uses and changes network- and company structures to adapt network and company to future development
user of network architecture	uses network structures to reach strategic aim	x	x	restructures company structures to reach strategic aims	x	x				
structural flexibility							adapts to changing environment by restructuring company structures	x	x	
awareness of interdependence among network agents	tries to position company in network	x	x							
							economic dependence on other network agents economic dependence on other network agents and on public governance financial support	x	x	
awareness of structures needed for innovation	builds up network structures for more variety	x	x	builds up network structures in company for innovation aim	x	x				
							company actively seeks cooperation partners for new business unit	x	x	
network promoter/ representer in BE	tries to position network in BE	x	x	tries to raise awareness in company for BE developments						
proximity to big players and Niche players	remains close to Niche player to enable value creation remains close to big player to enable innovation implementation	x	x	connects company units necessary to be informed about Niche player and Dominator developments	x	x	always considers impact of big and Niche player when it comes down to value creation	x	x	
Process dimension	awareness company dependency on environmental changes	x	x	discusses future changes in company	x	x				Is aware of network and environmental changes and developments, tries to influence them and position company in network and BE to fulfil company strategy.
	awareness of dependency on network position	x	x	raises understanding in company for resource invest in network in order to keep position	x	x				
	awareness of changes in company environment						company tries to react to changes in advance	x	x	
	Shaper of future developments						companies tries to shape future developments in network/industry	x	x	Tries to influence resource and KS on network level to gain strategically relevant knowledge for new business unit/ area.
	value creation trigger	x	x	tries to optimally use resources (expertise of agents)	x	x	tries to optimally use resources of employees	x	x	
	knowledge trigger	x	x	triggers knowledge development by asking for contribution	x	x				
	knowledge hub	x	x	triggers everyone and tries to get information or	x	x				

characteristics related to strategy dimensions	context									
	relational level (individual)			company level (individual)			Company/ business unit level (company)			
	actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II	Strategic relevance
	knowledge for knowledge areas from agents			knowledge for knowledge areas from employees						Gives away knowledge about strategic orientation in order to get knowledge back
KS platform due to formal and informal contacts							shares knowledge and innovative ideas through formal and informal contacts when strategically relevant	x	x	
trust builder for KS	individual tries to build trust through proximity, mutuality, frequency of interaction, inclusion and transparency (to different degree in both cases)	x	x	individual tries to build trust through proximity, mutuality, frequency of interaction, inclusion and transparency (to different degree in both cases)	x	x				
aware that not every kind of knowledge shared on all level of interaction	strategically creates room for knowledge shared on project level, network or BE level	x	x	strategically creates room for knowledge shared on project level, network or BE level	x	x				
open to KS to gain new business knowledge							company enables employees to engage in network and share knowledge	x	x	
awareness of dependency on big player/governance institution	tries to create independency in BE and network by innovation development	x	x	tries to create independency by adapting company to innovative ideas	x	x				
dependency on knowledge for new business development							tries to develop innovative technologies to keep network interesting or create new business ideas	x	x	
adaptability to changes	tries to figure out changes as early as possible and communicate them	x	x	tries to figure out changes as early as possible and communicate them	x	x				
adaptability to changes , already preparing to future changes							prepares company and network structures to be adjusted to future developments	x	x	
Content dimension	innovation trigger	x	x	triggers everyone and tries to get general innovative from agents	x	x				tries to create innovation by building up new business ideas and by following an innovation or open and collaborative (business) strategy
	innovation enabler	x	x	matches agents that could develop innovation	x	x				
	economic force field trigger (for innovation)	x	x	tries to influence developments in industry and across industries to enable innovation development						
	shaper of new technologies						engagement in development of innovation force field or innovation platform enables company to be	x	x	

characteristics related to strategy dimensions	context									
	relational level (individual)			company level (individual)			Company/ business unit level (company)			
	actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II	Strategic relevance
							shaper of new technologies			
lack of innovation implementation							lacks learning mechanisms to applicate and integrate knowledge and combine it to innovative ideas	x	x	
awareness of innovation need to create independency							company enhances room for employee engagement to enable them to develop innovative ideas, be creative; company engages in the development of a force field for innovation	x	x	
Legend: x: Verification in the Case; -: No verification in the Case										

Table 7.13: Strategic aims and strategic actions of Keystone strategy

Below, strategic aims and actions displayed in **Table 7.13** are further discussed.

On structural level, actions lead to the ability to build relations inside and outside the company to overcome resource dependency in BE and industry. Keystones follow a collaborative or open strategy (Whittington, Cailluet and Yakis-Douglas, 2011) in business areas they want to innovate in, in order to ensure value creation (Iansiti and Levien, 2004b). By consciously maintaining relationships and creating sub platforms for interaction (Mäkinen and Dedehayir, 2012) the Keystone extends its influence to fulfil the strategy followed.

Contributing to theory, Keystones balance relationships (Iansiti and Levien, 2004a) remaining close to big players in order to monitor developments and including Niche players for value creation. The degree of Keystone influence also depends on the strategic aim orientation. Iansiti and Levien (2004a) stated that Keystones are the agents that align their interest with the interest of the ecosystem. This is only partly true, as Keystones also actively try to influence their CR on all level of interaction by governing and influencing their environment in order to fulfil their strategic aims. Although there are strong relations between both cases, the degree of influence differs. Network agents are more included and less controlled in **Case II** than in **Case I**, where Keystones follow their strategic aim very

consequent. In **Case II** the aim is more adjustable. Still, both case studies reveal that the CR are built up and influenced alongside Keystone aims.

Additional to that, Keystones balance competition and collaboration between agents to enable value sharing, for example by regulating platform access. They constantly change network and company structures to adapt to future developments impacting company and network.

Keystones try to fulfil their collaborative strategy by building up relations consciously, using informal and formal structures as they exist in the network or BE they are active in. Keystones in **Case I** are still dealing with the challenge of a formalised environment and the access of CR in an informal way to enable resource sharing that lies beyond traditional business relationships. In contrast, in **Case II** where competition is existent but the environment is not as fast changing as in **Case I**, Keystones enable a collective strategy on collaborative relationship level by building up informal connections.

Trying to overcome interdependencies is an essential finding, contributing to theory by stating Keystone's motive for collaborating (Li and Garnsey, 2014). Independency though diversification is important as companies are not only influenced by the environment and by company specifics (Bea and Haas, 2009) but also by funding opportunities (Ansoff, 1965) to reach their strategic aims. Especially in competitive markets, differentiation strategy can offer an opportunity to reduce dependency from a single funding source (Porter, 1985). The essence is to create competitive advantage (Dyer, 1996) and be faster than others. Even though market competitiveness and degree of interdependencies differ in **Case I** and **Case II**, in both cases Keystone companies use CR to enable more independency (Lorenzoni and Baden-Fuller, 1995).

Findings also reveal that Keystones are shaped by a certain structural flexibility to adapt to environmental changes. Even though **Case I** is shaped by industry formality and mechanic and stable structures, being in an environment of control (Roffe, 1999), Keystone companies are shaped by organic and flexible structures that enable them to constantly adapt to the changing environment. Although, Company B in **Case I** is relatively big in company size, in comparison to other Keystone

companies investigated, the company is small in comparison to industry big players and is furthermore scattered into small entities managed as SME throughout the country.

All companies are characterised by less formally 'prescribed positions' (Grant and Baden-Fuller, 2004) and great employee responsibility to fulfil their role. Therefore, Keystone company structure does not constrain social relations but build a frame for social interactions (Grant, 1996b). Keystone companies enable individuals to be strategically involved in order to follow their collaborative strategy. In both cases Keystone persons are connected via an informal network inside their organisations, which enables them to be directly connected to decision makers and contributors, such as other employees.

As rules and routines are enabling the integration of new knowledge (Grant, 1996b) and Keystones mainly use their informal network structures for processing knowledge, Keystone companies are not good in knowledge integration but rather in knowledge exploration.

This corresponds to the aim of exploring new knowledge that could be strategically relevant knowledge, which leads to actions on processual level. The Keystone tries to influence KS processes on network and BE level to gain strategically relevant knowledge for new business ideas. He also occasionally gives away strategically relevant knowledge, in order to get knowledge back to create innovation. He is also aware of environmental changes and developments trying to influence them and position the company in CR. By engaging their individuals, Keystone companies also enhance a collaborative culture that enables KS (Goh, 2002), which is apparent in both cases. The individual tries to build trust through proximity and mutuality as well as frequency of interaction, inclusion and transparency. Keystone individuals in **Case II** are better able to enhance trust due to the high degree of informality in the network, even though all three Keystones work very engaged on building up trust. All these activities enable KS (Granovetter, 1973; Stacey, 1995; Grant, 1996a) and can overcome set structures (Szulanski, 2000). Keystones also strategically create room for knowledge shared on project level, network or BE level by influencing the building of platforms of interaction

such as project groups or network structures. These mechanisms are outlined in more detail in the findings section answering **RQ2**.

For the content dimension it can be revealed that Keystone individuals actively try to trigger innovation to create an economic force field of innovation. This can be related back to the company vision to be a shaper of the future. Companies being able to innovate can reach competitive advantage (Van de Ven, 1986; Martín-de Castro et al., 2011) therefore the creation of innovative ideas play a major role for Keystone agents. Interestingly, Keystone companies showed a lack in innovation implementation, as further outlined in the KS section.

Summarising the above, findings shown in **Table 7.13** revealed that Keystones follow a collaborative or open strategy to create independency from certain agents. They share knowledge and build on mutuality to get relevant knowledge back in order to reach innovation. This again positions themselves within CR they act in. To do so, they collaborate with other agents and follow an open strategy in business areas they want to innovate in. Results display that individual and company actions overlap when both follow a similar aim, which can be out of personal or strategic motivation.

7.3.3.3 Keystone agent position and links

In this subsection the adjusted model for BE agent analysis adapted from Adner (2017) is completed by introducing the findings on Keystone agent network position and links maintained. Positions specify where actors are located in the interchange of activities, links relate to transfer between actors which can be direct or indirect on BE level (Adner, 2017). As already outlined in the data collection chapter, the entry point of the agent analysis was the network being mainly shaped by direct interaction.

In order to better understand the Keystone position and Keystone linkages maintained, a network mapping analysis was conducted that took place on network level only. Again, the main reason was that a BE does not have set boundaries (Butel, 2014) and small phenomena explored on network level, being a structural part of the BE, can relate to bigger phenomena (Schatzki, 2011). Network mapping

results were already briefly outlined in the case study narrative in order to underline the Keystone identification, but are displayed in greater detail in this section to provide a comprehensive Keystone agent analysis.

The basis for the network mapping method was a network tie script sent out to all network agents of **Case I** and **Case II**. The network mapping matrix sent was based on a SNA but adapted to the qualitative analysis of the network. The data collection process is outlined in chapter five. As already explained, network agents were individuals acting for their company and answering the questions on behalf of their company always keeping their background in mind. As direct interaction takes place through direct contact, the individual agent was in the focus of investigation, seeing the company as the structure giving chart (Caimo and Lomi, 2014). As both are strongly linked to each other, company and individual will not be separated in this chapter. Grey boxes are agents that did not contribute. Agents that received the highest scores are located in the centre of the graphs. Different colours are used to display distinct relationships. Only high score relationships are coloured at all. In the following, the network mapping results of **Case I** are outlined first, complemented by the results of **Case II**. Major findings are again discussed in front of relevant literature, as well as the indications of the results complementing the Keystone agent role.

Network mapping Case I

After having considered all responses, 13 out of 16, being a response rate of 81%, a network matrix was developed that is displayed below in **Table 7.14**. Here, the questions asked are listed in the upper row and the individuals and company asked for are listed on the left hand side. Every individual was listed together with the company he works for, in order to ensure that network agents perceived other agents as being part of their companies. Due to anonymization the names are reduced to synonyms used. Matrix cell colours stand for related scores. Scores resulted out of the counts of how often network agents set a cross, saying yes to the question in the matrix. Out of that matrix relations could be shown being based on the questions asked. These relations are outlined in more detail below.

Question asked									
Name of other network members	I knew person before the network started	Relation is mainly build on contract we had or business we made together	Relation is mainly build on many meetings and conversations we had	Relation is mainly build on a friendship	The person is part of the founders of the network	We have very often contact	We have seldom contact	I often receive information or help if I ask for it	The person is well connected to other networks
Company B/ Person B	3	2	7		10	4	2	4	7
Company C/ Person C	4	2	9	1	8	4	1	1	4
Company A/ Person A	10	8	3	2	8	4	1	3	6
Company	2		5		9	3	4	2	2
Company			4		4	3	4	2	3
Company	3	3	6	1	6	1	6	3	2
Company	5	1	3	3	4	1	5	1	
Company	1		2		4	1	7	1	1
Company	2	2	2	2	4	2	3	2	1
Company	5	2	2	2	3	1	3	1	1
Company	4		6		5		4	1	1
Company	2	1	4		3	2	5	2	3
Company	5	1	1				5	1	2
Company			1	1			6	1	
Company	1	1	2	1		1	6	2	
Company			1				6	1	2
Company	1			1				1	1
Company	1	1							1

Scores
7 to 10
5 to 6
3 to 4
1 to 2

Table 7.14: Network matrix Case I

Table 7.14 shows that Company A, Company B and Company C have by far the highest scores for most of the questions. This confirms the importance of all three actors to the network. It underlines the perception of a network core, which has been already introduced by the expert interview and case study findings. They are also the founders of the network together with another company that does not have any other particular influence in the network. The bold and horizontal frame marks the scores

of all three core companies. They have the most connections and consequently a higher influence in the network. The last column shows that all three core companies are seen as bridges to other networks, whereas Company B rated to be most well connected by network agents. The red bold frame shows that the network as a whole is a very sparse network where many nodes have seldom contact and where a central player seems to exist at the centre. Altogether, the network matrix displays that the three core agents are considered to share the key tasks of network development. They founded the network, provide contact and enable interaction.

The following graphs, based on the network mapping matrix, display the interconnections based on the questions asked and the answers given by all network agents. Network relations are drawn and displayed in **Figure 7.14-7.18**.

In **Figure 7.14** agents were asked if they knew each other before the network started. Arrows show the connections confirmed. Arrows pointing in two directions mean that the connections mutually confirm each other. Not all connections confirm each other due to infrequency of interaction among agents. As the network exists already for more than six years, relationships stated here are considered to be long-standing relationships. They are relationships that were existent before the network started. Findings underline what observation and interview data already revealed. Nearly all network agents are connected to each other by a long-standing relationship. Company A is not alone in the centre as in **Figure 6.1**, but stands together with other companies that engaged into network development in the past. Company B and C were the ones that engaged actively in network development as shown in timeline in **Figure 6.2**. Although Company A is considered to be the main driver of industry developments in the region, as also displayed in **Figure 6.2**, **Figure 7.14** reveals that many network agents already had a relationship of any kind in the past and that network agents are connected with each other due to that mutual past.

Question I: I knew person before the network started

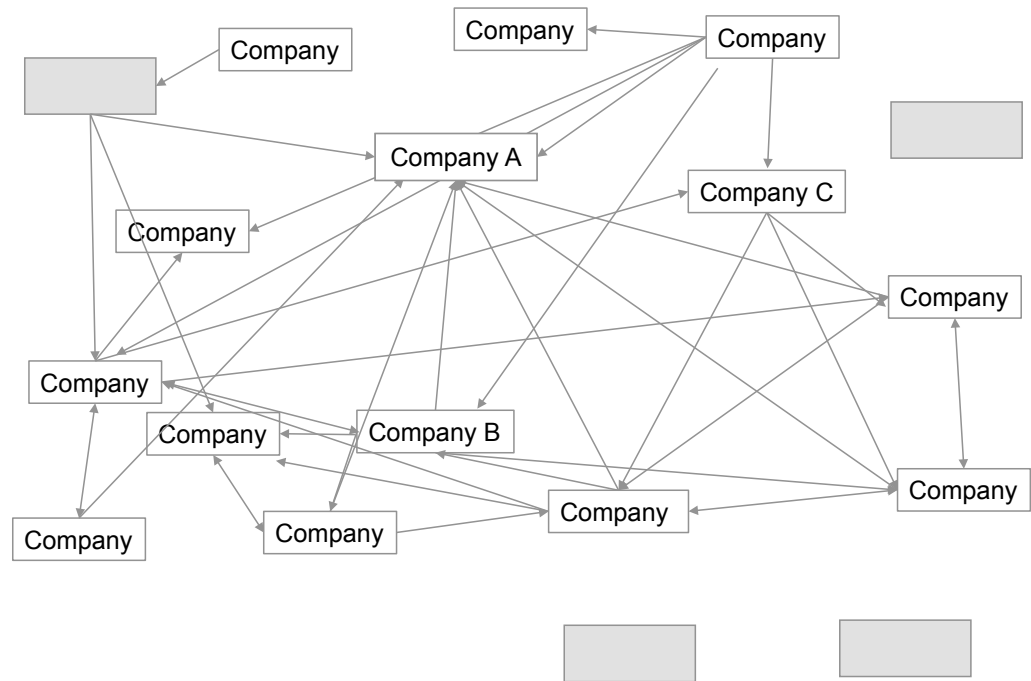


Figure 7.14: Display of long-standing relationships

Figure 7.15 contrasts **Figure 7.14** by revealing that even though many network agents already had a relationship in the past and many network agents are connected with each other by a business relationship, a high centrality exists when it comes down to business relations. Here, the question was if the relation is mainly build on a business relationship. Company A, being the Dominator of **Case I**, consists of the most nodes that are based on business relationships. Besides the Dominator, Company B and C hold more nodes than the others, also shown by the network mapping matrix in **Table 7.14**. The relationships referring to Company A are coloured to show that here the highest score of nodes is visible. This means Company A is a network hub when asked for business relationships. Company B and C have far less business influence on other network agents than Company A, still they are better connected to other network agents than all the other agents displayed. Interestingly, Company B is connected by a business relationship with Company A while Company

C is not. This confirms the case study narrative in chapter six where Company C was described as being a company that wants to engage with the Dominator by using network dynamics to do so.

Question two: Relation is mainly build on contract we had or business we made together

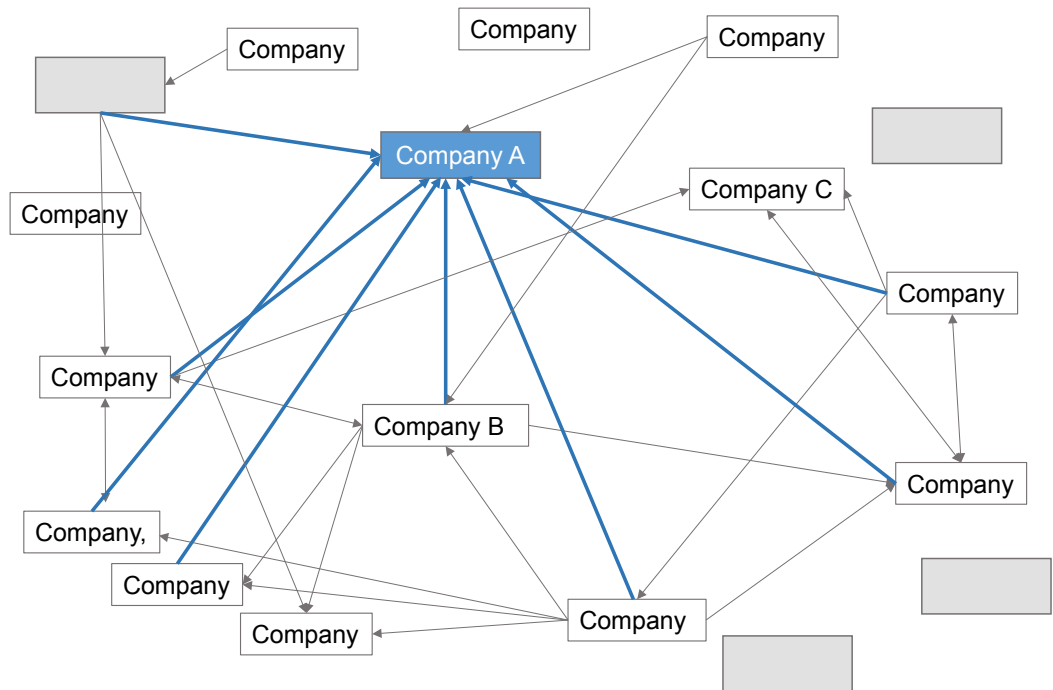


Figure 7.15: Display of business relationships

In **Figure 7.16** relationships displayed are based on frequent direct interactions such as meetings. A different colour is chosen to enable a differentiation between the results displayed in **Figure 7.15** and **7.16**, which are merged in **Figure 7.17**. **Figure 7.16** shows that Company B and C are in the centre of relationships build on frequent interaction. Company B and C together build the platform for direct interaction in network meetings, which is confirmed by network observations as well (NOI-VII). Therefore, Company B and C can influence other network agents mainly through direct interaction they maintain with them. For Company A only very little relationships is built on frequent interaction. Network observations showed that Person A was seldom taking part at network meetings, which confirms this result.

Question three: Relation is mainly build on many meetings and conversations we had

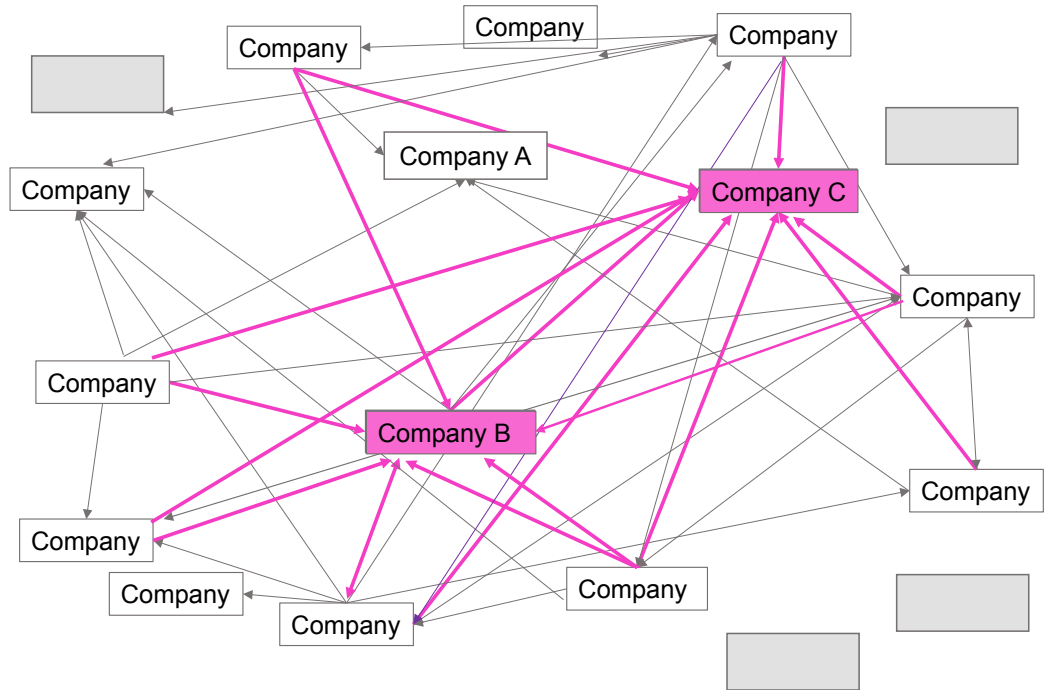


Figure 7.16: Display of relationships based on frequent interaction

Additional to **Figure 7.16**, **Figure 7.17** merges business relationships and relationships based on frequent interaction. Different colours are used in order to show what relationships are related to whom. Blue relationships are based on business relations and pink on frequent interaction. All grey lines relate to other network agents that had less than a score of six nominations. Here, it can clearly be seen that three central players exist, all three of them were identified as the network core through interviews and network meeting observations. Company A's centrality is based on very formal relations, mainly on business relationships, whereas Company B's and Company C's relationships are based on frequent interaction with other network agents. Additional to the results displayed in the graphs above, Company B confirmed that Company A is a business partner that he knew before the network started (NMP_Company B_2016), furthermore Company A is an important client Company B keeps proximity with (BD2, 2016). Whereas Company C mentions Company A as one of the most influential network agents that he wants to do business with (NMP_Company C_2016; C1). The

finding confirms that centrality depends on the relationship asked for, which was already introduced as one experts finding above.

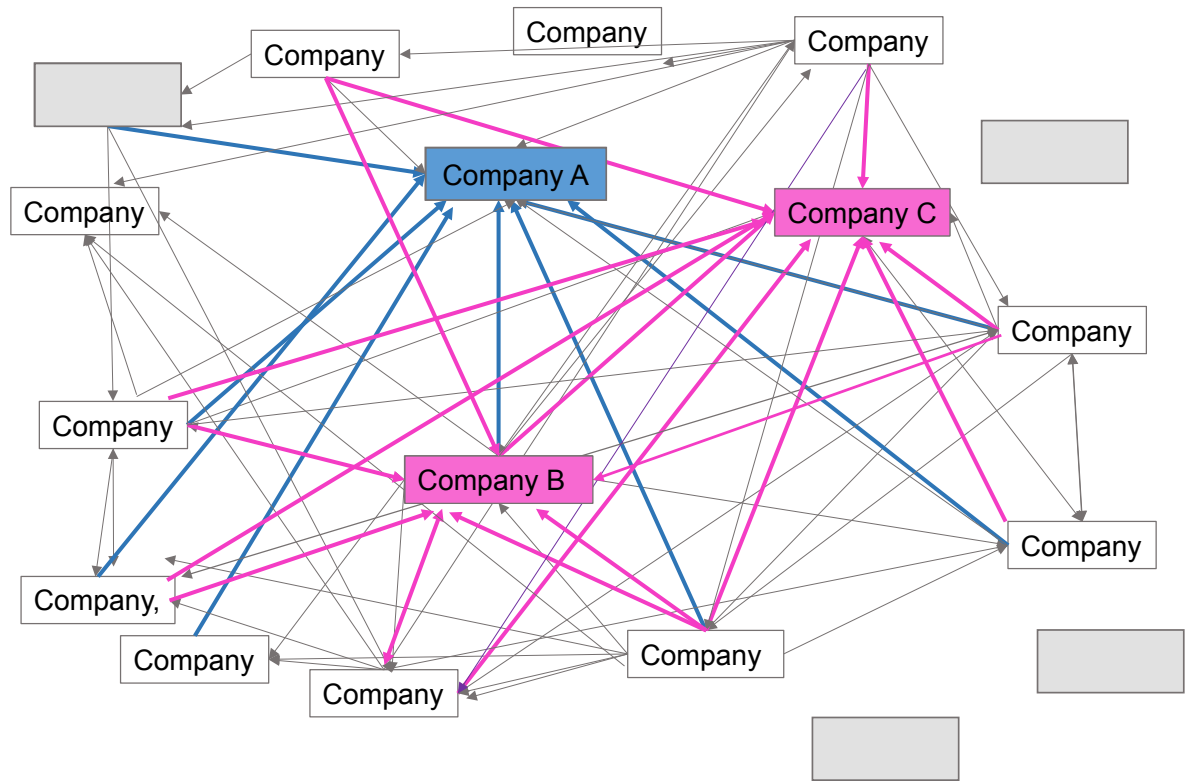


Figure 7.17: Display of relationships based on business relationships and frequent interaction

Figure 7.18 displays relationships that are based on a friendship. Friendship ties only exist between few members of the network. Here, even a different company, a niche company that contributed frequently during network meetings but did not engage in network development, contains the most nodes (NOI-X). Company B and C reported that this Niche player company influences network dynamics and both need to actively consider contributions of this agent to ensure positive network developments (NOIII).

Question four: Relation is mainly build on a friendship

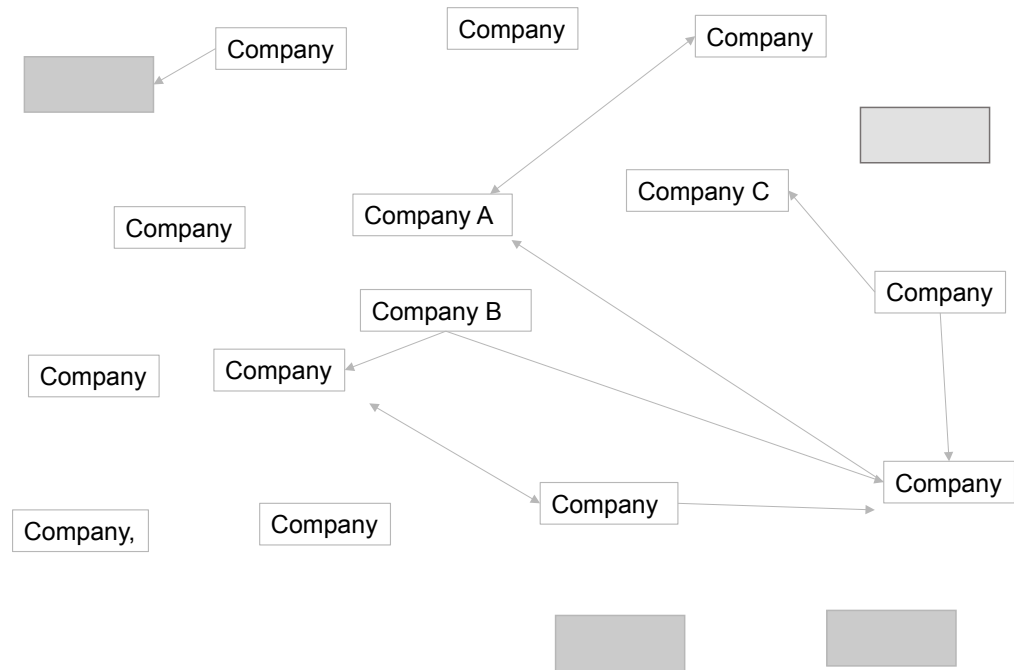


Figure 7.18: Display of relations built on a friendship

Altogether, network mapping revealed that not only Company A is in the centre of network activity but also Company B and C. Together they build a network core of network agents influencing network dynamics on the basis of different relations. This also corresponds to the path dependency of network development (Arya and Lin, 2007) and the importance of Company A, B and C throughout network history as displayed in **Figure 6.2**. Although Company A is not officially part of the management board of the AVD in **Case I**, it is still considered to be in the centre of network dynamics due to its influence on business relationships. Interestingly, Company A, B and C can be located in the centre of the network due to distinct relations they are built on. Also, network observation confirmed a strong direct interaction between all three network agents (NOI-X) but there was no confirmed connection between them listed in the network matrix. This phenomenon is confirmed by statements made by Person B who made sure that Person A/ Company A is not directly involved in network dynamics anymore due to his business impact that has a substantial influence on network dynamics. Nevertheless, network observations and interviews with other agents revealed that Person A/

Company A still influences network dynamics by directly interacting with Person B/ Company B and Person C/Company C (NOI-VIII; F1).

Network mapping Case II

As in **Case I**, after having considered all responses, 15 out of 27 (response rate 55%), a network matrix was developed for **Case II** that is displayed below in **Table 7.15**. All formatting in this section corresponds to the formatting of **Case I**. Again, relations can be revealed being based on the questions asked.

Questions asked									
Name of other network members	I knew person before the network started	Relation is mainly build on contract we had or business we made together	Relation is mainly build on many meetings and conversations we had	Relation is mainly build on a friendship	The person is part of the founders of the network	We have very often contact	We have seldom contact	I often receive information or help if I ask for it	The person is well connected to other networks
Company A/ Person A	11	4	9	8	9	10	1	10	12
Institution B/ Person B	8	3	5	2	5	5	4	4	10
Company C/ Person C	1	1	2		3		7	3	4
Company			2	1	1		8		
Company			1				8	1	
Company	1	1	2	1		1	6	2	1
Company	3	2	2		2	1	8	2	1
Company		1	2	1			6	2	1
Company	2	2	2		2		8	2	7
Company	1	2	2		1		8	2	2
Company	4	1	3	3	4	3	5	7	1
Company	3	1					8	2	
Company	4	1	2	1	3	2	4	3	2
Company	5	2	6	5	5	5	1	5	5
Company		1	3	5	1	1	6	2	2
Company	3	2	5	4	4	5	2	4	3
Company			5	1	2		5	1	1
Company	2	1		1		1	7	1	1
Company		2	3		1		8	1	3
Company	2	1	3		1	1	7	2	5
Company	2	1	3				7		3
Company	4	1	10	3	3	4	2	4	3

Questions asked									
Name of other network members	I knew person before the network started	Relation is mainly build on contract we had or business we made together	Relation is mainly build on many meetings and conversations we had	Relation is mainly build on a friendship	The person is part of the founders of the network	We have very often contact	We have seldom contact	I often receive information or help if I ask for it	The person is well connected to other networks
Company	1		1	1			6		1
Company	1	2	3	1	1	2	6	2	1
Company		1	5				6		3
Company			3			1	6		
Company			3				6	1	

Scores
9 to 12
6 to 8
3 to 5
1 to 2

Table 7.15: Network matrix Case II

Table 7.15 reveals that Company A and Institution B have by far the highest scores for most of the questions. Interestingly, and as already outlined in the case study narrative, Person C is not rated with high scores even though he is engaged very deeply into network dynamics due to his financial contributions (CCD4, 2016).

The bold horizontal frame displays that the two agents with the most connections are Company A and Institution B as already confirmed by network observations (NOI-III). They are also seen as connectors or bridges to other networks as shown by many nominations in the last column of the matrix. Company A is rated to be best connected by the other network agents. The bold vertical frame displays that the network development was, beside the importance of Company A and Institution B, also triggered by former founders of the network. These founders have been outlined in the case study narrative as being the former network core that follow a slightly different interest now but are still part of the network. One company, well known from network meetings, scored with ten nominations. This company is very frequently attending at meetings but did not show any strategic interest (NNOI-V). Altogether, the network is very sparse, where most nodes have seldom contact and are mainly

connected to Company A (red bold frame).

As above, the following graphs, **Figure 7.19-7.23**, were developed based on the network matrix showing interconnections derived from network agents answers.

Figure 7.19 relates to long-standing relationships of the network. As the network exists already for more than six years, these relationships are considered to be long-standing relationships that were existent before the network started. Findings underline what observation and interview data already revealed. A certain centrality of long-standing connections can be seen. Companies located in the peripheries were often connected to only one or two other companies as displayed in **Table 7.14**, while Company A and Institution B are in the centre of a number of long-standing relationships. In this case not all agents are interconnected. The graph also shows that a network core of relationships exists that confirm each other (thick arrows) and that some of the long-standing relationships are in the periphery now. The periphery is shown by an outer circle corresponding to **Figure 6.7**. Companies were situated in the periphery due to their very little current influence on the network observed in network meetings and interviews and due to low score in the matrix (NNOI-III; AA10; DD1). Company A, Institution B and Company C confirm each other their long-standing relationships and were identified by network meetings and interviews (NNOI-V; AA10; DD1) as being the network core. Other than in **Case I**, network agents here confirm their mutual relationships. The network core can therefore be confirmed by mutual confirming relationships and observation at the same time.

Question I: I knew person before the network started

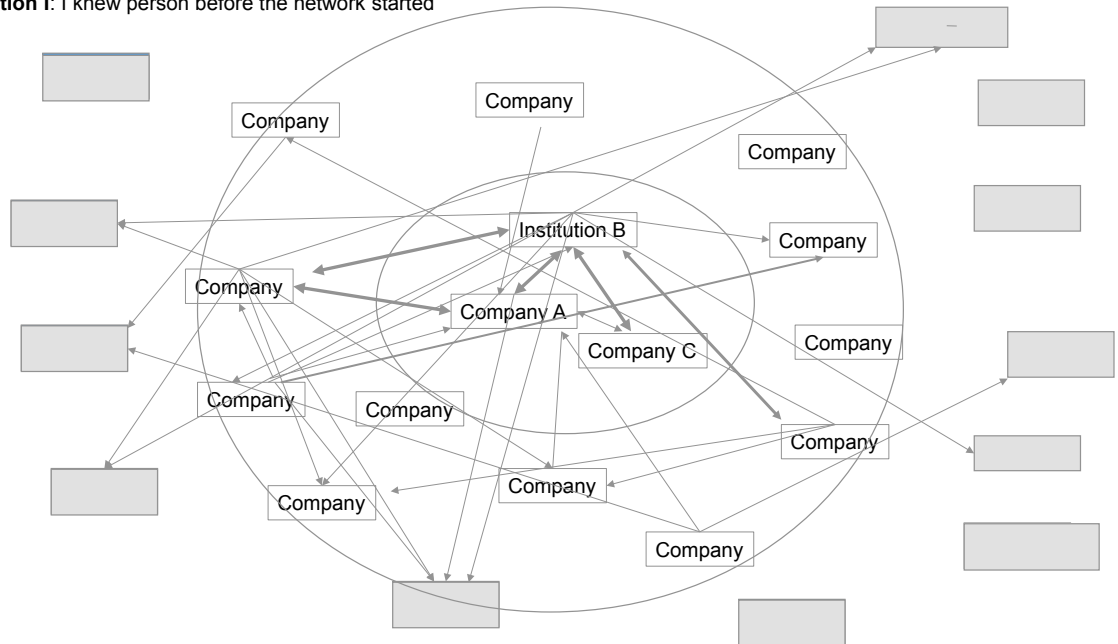


Figure 7.19: Display of long-standing relationships

For building **Figure 7.20** the question was asked if the relation is mainly build on a business relationship. Surprisingly, most companies consider to be related to Institution B by formal relations even though Company A is formally managing the network as Network Management Company. During interviews, network agents mentioned Company A as being the key trigger for the network developments and they are connected to the company by contracts for network membership. Nevertheless, Institution B holds the most connections when business relationships are considered. Even though Company A is the Network Management Company, it is not considered as a business partner by the network agents. The result confirms the importance of Institution B for business realisation in the network and the description by other network agents that Institution B is an important business contact provider (NNOI-III; AA8). This is additionally supported by the actions of Company A building mainly on informal relations that do not foster business relations (NNOI-V).

Question two: Relation is mainly build on contract we had or business we made together

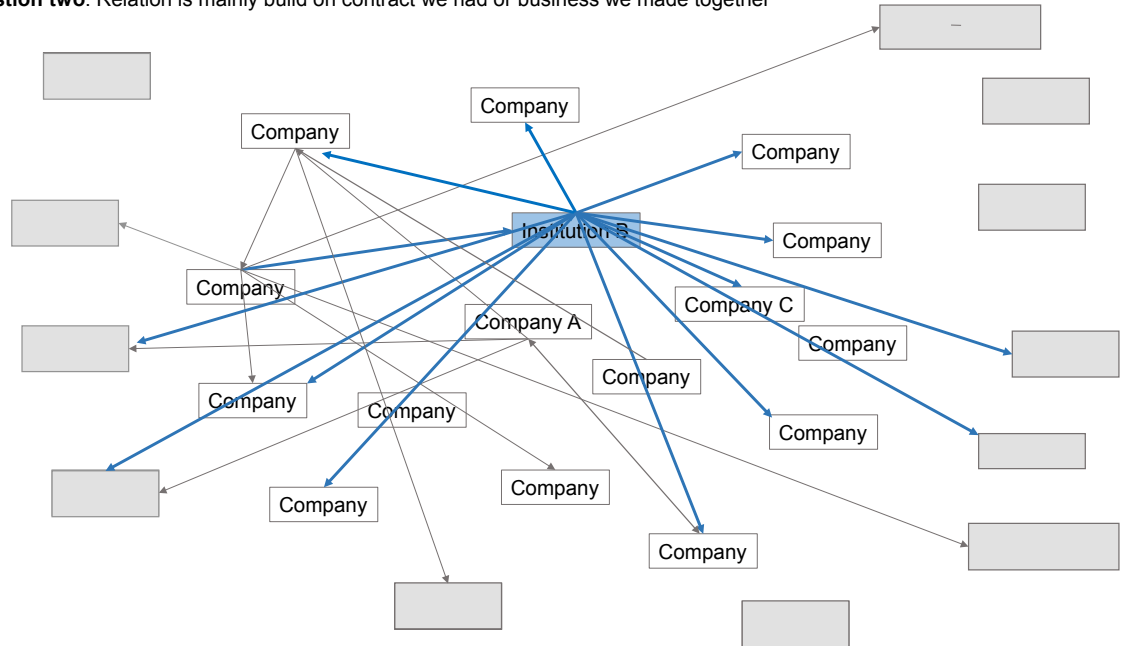


Figure 7.20: Display of formal relationships

Figure 7.21 shows that almost all agents know each other from frequent interactions and meetings they had. Still, agents in the outer periphery did not connect with each other but are connected via Company A with other agents of the network. Due to their possibility to connect during network meetings they could build up direct relations to each other by themselves. Company A builds a central network management unit and provides the platform of direct interaction through network meetings (NNOI-III) influencing other network agents mainly through direct and frequent interaction.

Figure 7.22 underlines that the network is a centralised network. Nevertheless, there is no single central firm but at least two recognised firms that are situated in the centre of the network. The graph merges business relationships and relationships based on frequent interaction. Here, it can clearly be seen that two central players exist, both were identified through interviews and network observations as being the network core. Institution B's centrality is based on very formal relations, mainly on business relationships, even though Person B engages out of personal interest in the network. As Institution B is such an important institution in the sports industry, it is rather impossible to not engage through a business relationship with them. This also confirms that Institution B is seen as an important

bridge to other networks (**Table 7.14**). Company A's relationships are mainly based on frequent interaction with other network agents, which confirms what network agents were coherent with in their interviews. Company A is mainly known for its informal way of interaction and informal way of addressing network agents (DD1, 2016). Company A and Institution B as well as Company C keep a close proximity to each other by frequent interaction (NNOI-III; IB1, 2016).

Question three: Relation is mainly build on many meetings and conversations we had

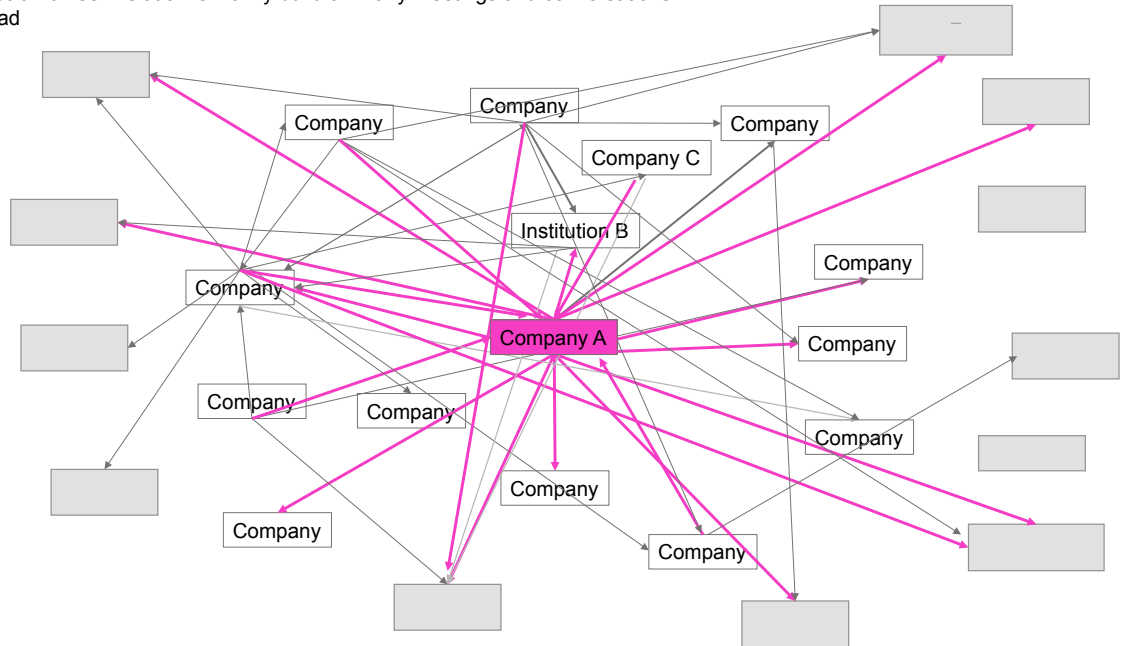


Figure 7.21: Display of relationships build on frequent interaction

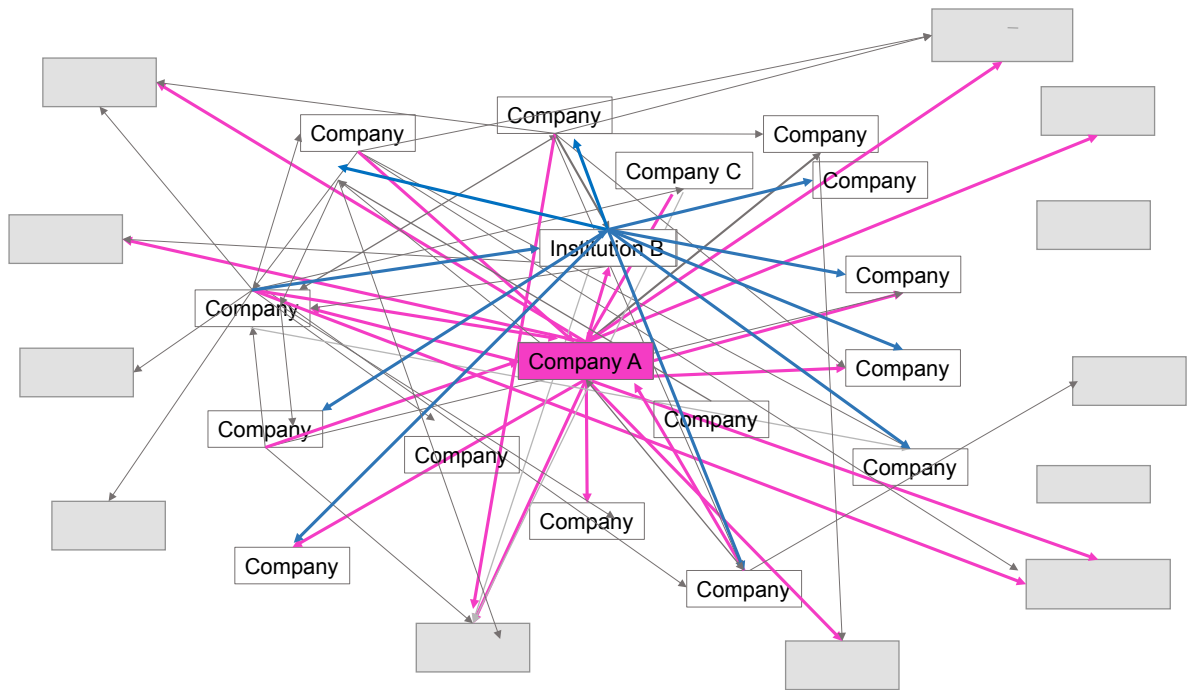


Figure 7.22: Display of relationships based on business relationships and frequent interaction

Question four: Relation is mainly build on a friendship

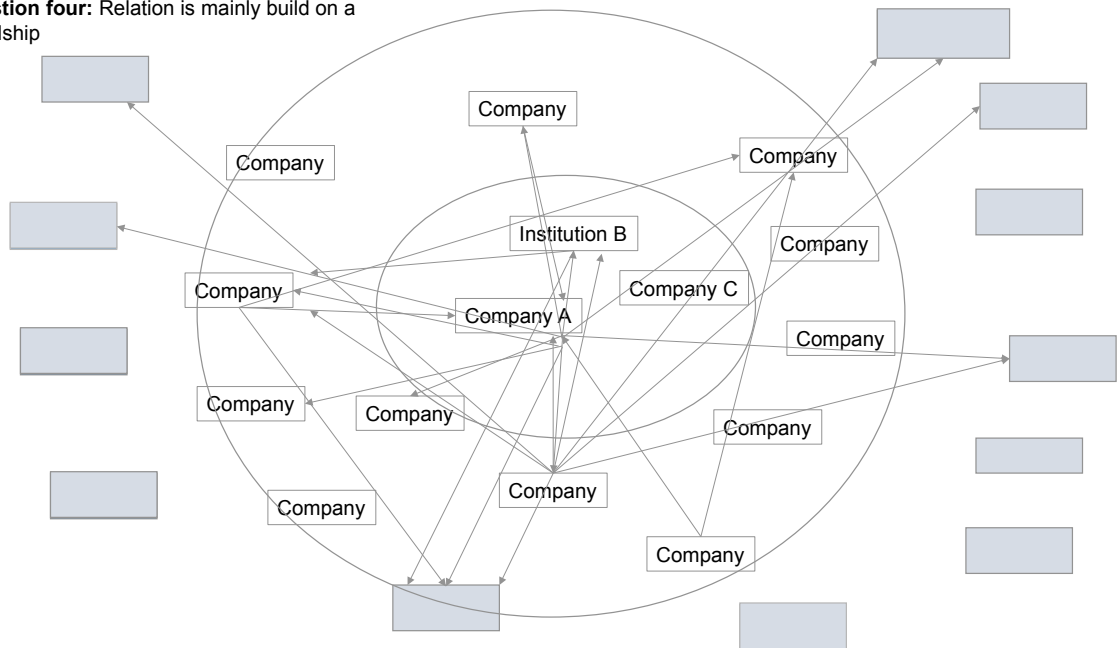


Figure 7.23: Display of relationships build on friendship

Additionally, in **Figure 7.23** many friendship ties are confirmed and underline the perceived informality in the network (NNOI-III). Here again, the periphery, marked as an outer circle, contains

some of the long-standing relationships based on friendship that are not active in the network core anymore. **Table 7.14** confirms that Company A consists the most connections build on a friendship. This corresponds to the importance of Company A being based on frequent interaction and not on business relationships. Additionally, the findings relate to observation findings when Person A connected in an informal way with network agents and immediately had a direct access but was later not able to build a business relationship from that connection (NNOI-V). Surprisingly, Company C being an important core group agent in order to keep the network active, due to his resource contributions (NNOI-III), did not confirm the friendship in the network mapping matrix. Because of his financial support and its background activities it is possible that he does not display his connections openly. This corresponds to the other results, which showed that Company C is not recognised by other agent as an important network member.

Having outlined the main linkages and positions in **Case I** and **Case II** the Keystone agent attributes are outlined below and contrasted to current literature.

Links and Position of Keystone agents

In this section links and positions maintained are outlined in more detail, analysed from a Keystone perspective. Linkages and positions are analysed in front of the above introduced dimensions (**Figure 7.11**) of Adner (2017) that refer to links and positions as important elements to describe a BE and is here used for exploring the Keystone role. Naturally, links and positions interrelate and build on each other as is considered in the following section. Furthermore, network terminology is used here, to describe the Keystone and his network specifics. Although, network analysis had been adapted in a qualitative way and not been used for BE agent analysis so far, it offers definitions and a terminology that helps to describe Keystone specifics. How the terms are used is introduced in more detail below. Terms that mean a certain measuring method in quantitative network analysis, such as structural holes or tie strength (Scott, 2017), are explained and used by their definitions only. In the following, Company B for **Case I** and Company A for **Case II** will be referred to as Keystone companies to enable a clear characterisation. While in **Case I** Company C has been identified as Keystone company

as well, Company B has a higher influence in the network due to his direct connection to Company A, the Dominator. A connection Company C is still striving to.

In **Case II** Person B/ Institution B and Person C/Company C have been identified as being part of the Keystone group, but both are acting on a personal interest basis only. Therefore, Company A is investigated for **Case II** to explain network attributes of the Keystone agent.

Links maintained define relations maintained and therefore refer to relational embeddedness (Ahuja, 2000). Many ties maintained mean a certain tie richness (Gulati, Lavie and Madhavan, 2011), which can enable the access to a great number of knowledge links, therefore enabling knowledge access (Tsai, 2001). As shown in the network mapping table and graphs above, all Keystone agents consist of a high number of linkages. The number differed by type of relation asked for, but are overall shaped by a high relational embeddedness. As tie strength (Granovetter, 1973) was not measured, strong ties are defined by intense interaction between partners (Uzzi, 1996; Williamson, 1985) based on a mutual and deep understanding and strong social control methods (Rowley, Behrens and Krackhardt, 2000). Weak ties are shaped by infrequency of interaction (Granovetter, 1973). As can be summarised from network mapping, Keystone agents hold a strong relationship between each other in the network core they act in. This was not explicitly visible in the network mapping graphs of **Case I** as already outlined above, but implicitly by referring to the founders of the network as being the network core agents shown **Table 7.13**. The core companies are involved in network developments for a long period of time already influencing the future of the network. Person B/ Company B in **Case I** outlined in the interviews that a great proximity to the big player would negatively influence network dynamics (B1; B2). Possibly, this is one reason why the Keystone core does not confirm a close interaction. A network core group was visible from the beginning to the end of investigation in **Case I** and **Case II** (NOI-X; NNOI-III). A possible existence of a network core group has already been described by the experts. Observations revealed that even though, there seemed to be always one leading core agent, which is confirmed by the considerations outlined above, all core group members were collaborating closely (NNOI-V; NOI-X). In **Case II**, network mapping showed explicitly mutually confirming

relationships that were existent before the network started, forming a network core group of developments in the past. As outlined in the case study the network core group changed due to changing interests and consists now of Person A/ Company A, Person B/ Institution B and Person C as confirmed by interviews and observations (NNOI-III; IB1,6). Consequently, the network core can be considered as mutually confirming strong ties characterised by trust and detailed information exchange (Uzzi, 1997; Larson, 1992; Krackhardt and Hanson, 1993).

In terms of Keystone's relational embeddedness into weak ties, being shaped by infrequency of interaction (Granovetter, 1973), a generally high embeddedness can be seen in **Case I** and **Case II** referring to all Keystone agents. Infrequency of interaction is defined in this case as interaction that is not mutuality confirmed by the agents. Especially relationships build on meetings were not mutually confirmed. Probably, as meeting contacts do not always result into frequent direct contact. Consequently, the relational embeddedness refers to relations that are based on frequent meetings or conversations. From that perspective, Keystones in **Case I** and **Case II** contain a high number of weak ties enabling a variety of information to collect (Brass et al., 2004). They can bring in new knowledge (Burt, 1992) as they often act as bridge to other networks.

Business relations refer to the players with the highest economic impact in the network. Relations build on meetings can also be seen as informal relations. Keystones are therefore highly embedded into weak and more informal ties being in the centre of relations build on frequency of interaction that are not shaped by a business relationship. These relations are more informal than formal referring to the socialisation of agents (Dhanarag and Parkhe, 2006).

In **Case I** only very little relationships build on a friendship, whereas in **Case II** the Keystone company is in the centre of a net of friendships, which is confirmed by a higher strategic orientation of the Keystone in **Case I**.

Both networks consist of one player that is in the centre of business relations. A vast number of Niche players are connected to Dominator and Keystone depending on the relationship asked for. Keystone

agents ensure the proximity to the economically central player by being either informally or formally connected to him but also by including him into the network core group (NNOI-V; NOI-X).

Summarising the above, Keystone agents are connected by strong ties shaped by a direct and close interaction to a network core group that has also been important for network development throughout network history. They are embedded into weak and more informal ties that they address mainly through meetings to bring in new knowledge. Furthermore, they keep proximity to Niche players and central economic players by combining all ties and providing a platform of interaction, being meetings conducted.

Keystones are often named platform leader, orchestrator and knowledge hub in literature (Iyer, Lee and Venkatraman, 2006). These terms refer to a certain position. Positions in network structures result out of the relations maintained (Ahuja, 2000). They are defined by the activities that position actors in the system (Adner, 2017). A hub firm is placed in a central network position, shaped by a high number of links (Battistella et al., 2013). Hubs are also named focal firms (Adner and Kapoor, 2010; Adner, 2012; Kapoor and Lee 2013; Scott, 2017). Centrality is often seen as a Keystone position as his influence is explained by the number of nodes he can contain (Iansiti and Levien, 2004a). Network mapping showed that the Keystone position in **Case I** and **Case II** is only a central one, when asked for relations build on frequent meetings or interactions. When business relations are investigated the Keystone is not placed in the centre of the network. This confirms the notion that he maintains a platform of interaction and that he can be a platform leader (Majava et al., 2016) but of informal relationships.

In general, both networks in **Case I** and **Case II** contain a high centrality as most agents have only seldom contact but seek interaction over the platform that the Keystone provides. This confirms the selection criteria of a centralised network for both cases, as outlined in the data collection chapter. Altogether, the centrality of both networks relates into a small structural embeddedness, meaning the interconnectedness of the agents (Burt, 1992; Coleman, 1988). Agents could be more embedded as they know each other but they engage mainly through the platform the Keystone provides. Sparse

networks are supposed to be less dense and closed, therefore being less able to create trust and cooperation, but can better access resources from the outside, and develop innovative ideas due to structural holes (Burt, 1992; Coleman, 1988). Structural holes develop when infrequent interaction takes place (Burt, 1992; Gulati, Lavie and Madhavan, 2011).

How close and how open the network is can be defined through the access possible. Closed and highly embedded networks are supposed to have a better control and communication than open networks (Ahuja, 2000; Coleman, 1988; Walker, Shan and Kogut, 1997), which is contrasted by the idea that centralised networks, that are less embedded could offer the same (Lorenzoni and Baden-Fuller, 1995). In this work, Keystones controlled access due to their influence on the platform of interaction being the meetings (NOI-VIII; NNOI-III). Ahuja (2000) introduces sparse networks where agents do not know each other. As everyone in the network knows about each other in **Case I** and **Case II** but is not connected by direct interaction, Keystones can regulate the access to the platform of interaction quite well.

Table 7.8 displays that Keystones are often referred to as being bridges to other networks. This is supported by the network mapping matrix of **Case I** and **Case II** (**Table 7.14** and **7.15**) as Keystones are considered to have a high number of contacts outside of the network. Bridging firms are companies that connect to other networks or that can provide contacts to circles that are otherwise not accessible (Iyer, Lee and Venkatraman, 2006; McEvily and Zaheer, 1999). Results confirm that Keystones can act as Platform leaders as well as bridging ties to other networks. This is an important new finding related to the Keystone position.

The Keystone role was outlined in this subsection by a Keystone characterisation, by his activities that influence strategy making and by his positions and links in order to answer **RQ1**. How the research question can be answered by taking all the considerations into account is outlined in the discussion chapter.

7.3.4 Knowledge management of Keystone agents

In this subsection results are discussed that relate to **RQ2**. As the question is related to KS processes, activities of the Keystone were related to KM activities. The activities again are linked to the KM stages that have been identified in the literature review section. These stages are knowledge creation, KS and knowledge application (Liu et al., 2014; Grant, 1996a; Spender, 1992).

In the following, Keystone activities linked to the KM stages are outlined in **Table 7.16** and are subsequently analysed in front of current literature. Results displayed in **Table 7.16** build on **Table 7.8** and **7.9**. Results are structured by first outlining the characteristics that are related to the actions in the left hand column of **Table 7.16**. Actions are then outlined related to the individual and the company level. The individual level is split into company and relational level, as actions sometimes differed slightly by agent level of interaction. The knowledge creation and the KS stage contain the most actions, the knowledge application stage comprises only very little activity. Bold lines mark activities that relate to each other. Characteristics marked in grey show differences between Keystones in **Case I** and Keystones in **Case II**. Differences between the two cases are considered in this section as KM activities differ by relationships maintained, for example being more formal or informal relationships (Caimo and Lomi, 2014).

KM stages	characteristics	context								
	related to knowledge stages model	relational level (individual)			company level (individual)			Company/ business unit level (company)		
		actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II
Knowledge creation	Company dependent on complex know-how/technology development							tries to develop innovative technologies to create independency from big players	x	
	Company dependent on knowledge to keep creativity as a selling preposition							tries to develop innovative technologies to keep network interesting		x
	awareness of innovation need in company to create independency							company enhances room for employee engagement to enable them to develop innovative ideas, be creative; company engages in the development of a force field for innovation	x	x
	Individual awareness innovation need to develop new business (unit)	strategically addresses agents to contribute knowledge		x	strategically addresses agents to contribute knowledge	x	x			
	Individual aware that not every kind of knowledge shared on all level of interaction	Individual tries to build up different platforms of	x	x	Individual tries to build up different platforms of interaction to enable	x	x			

	characteristics	context								
KM stages	related to knowledge stages model	relational level (individual)			company level (individual)			Company/ business unit level (company)		
		actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II
		interaction to enable knowledge creation			knowledge creation in company					
	Individual as innovative idea developer				Individual brings in innovative ideas in order to get innovative ideas back	x	x			
	Individual as knowledge creator				samples areas in company that require knowledge creation	x	x			
	Individual as trust holder for innovative ideas	brings others to share innovative ideas by active trust building through mutual idea sharing		x	brings others to share innovative ideas by active trust building through mutual idea sharing		x			
	Individual as knowledge trigger	triggers everyone and tries to get information or knowledge for knowledge areas from agents	x	x	triggers everyone and tries to get information or knowledge for knowledge areas from employees	x	x			
	Individual as innovation trigger	triggers everyone and tries to get general innovative from agents	x	x	triggers everyone and tries to get general innovative from agents	x	x			
	Individual as innovation enabler/ matcher	matches agents that could develop innovation	x	x	matches agents that could develop innovation	x	x			
	Individual as personal interest trigger for KS	triggers agents to share knowledge by addressing their personal interests		x	triggers employees to share knowledge by addressing their personal interests		x			
	Individual and company open to KS to gain new business knowledge							company enables employees to engage in network and share knowledge	x	x
Knowledge sharing	Individual as knowledge protector	Individual protects knowledge that belongs to traditional business unit	x		Individual protects knowledge that belongs to traditional business unit, also among other business units	x			x	
	company as knowledge hub due to informal contacts			x				shares knowledge and innovative ideas mainly through informal contacts to enhance interaction		x
	company as knowledge hub due to formal and informal contacts		x					shares knowledge and innovative ideas through formal and informal contacts when strategically relevant	x	
	Individual as knowledge hub	Individual connects strategically necessary agents by frequent interaction	x	x	Individual connects strategically necessary employees by frequent interaction	x	x			
	Individual as knowledge hub architect	Individual tries to influence frequency of interaction and type of interaction among agents; often needs to trigger interaction	x	x	Individual triggers interaction among strategically relevant employees	x	x			
	Individual aware that not all knowledge shared in all levels of interaction	strategically creates room for knowledge shared on project level, network or BE level	x	x	strategically creates room for knowledge shared on project level, network or BE level	x	x			
	Individual as trust builder for KS	Individual tries to build trust through proximity, mutuality, frequency of	x	x	Individual tries to build trust through proximity, mutuality, frequency of	x	x			

	characteristics	context								
KM stages	related to knowledge stages model	relational level (individual)			company level (individual)			Company/ business unit level (company)		
		actions	Case I	Case II	actions	Case I	Case II	actions	Case I	Case II
		interaction, inclusion and transparency (to different degree in both cases)			interaction, inclusion and transparency (to different degree in both cases)					
	Individual as user of advice relations for KS	when available individual uses advice relations to access and share knowledge (less available in structures that are less formal, less available in BE)	x		when available individual uses advice relations to access and share knowledge	x				
	Individual as social relation architect for KS	tries to enhance informal KS network	x	x	tries to enhance informal KS network	x	x			
Knowledge application	Individual and company proximity to Niche and Big players	remains close to Niche player to enable value creation remains close to big player to enable innovation implementation, contacts business units needed	x	x	remains close to Niche player to enable value creation remains close to big player to enable innovation implementation, contacts business units needed	x	x	company keeps close interaction to big players	x	x
	company as shaper of new technologies							engagement in development of innovation force field or innovation platform enables company to be shaper of new technologies	x	x
	company lack of innovation implementation							lacks learning mechanisms to applicate and integrate knowledge and combine it to innovative ideas	x	x
Legend: x: Verification in the Case; -: No verification in the Case										

Table 7.16: Knowledge management stages of Keystone agents

Summarising the activities displayed in **Table 7.16**, individual and company actions overlap and are aligned to each other. The detailed KM activities are outlined in the next paragraphs. Overall, findings revealed that Keystones concentrate on knowledge exploration rather than exploitation being related to the generation of new knowledge (Grant and Baden-Fuller, 2004). Additional to that, the Keystone company is dependent on knowledge in order to keep the network interesting or create independency from big players, therefore aiming for innovative ideas to follow its diversification strategy.

In order to enable knowledge creation, Keystones offer room for employee engagement to enhance knowledge creation among agents and enable exploration. The Keystone individual being aware that innovation is needed to further develop new business areas, strategically addresses agents to contribute useful knowledge. Knowing that not every kind of knowledge shared on all level of

interaction, project groups are developed that should enable the sharing of more specialised knowledge between the agents to enhance value creation. This refers to the knowledge sharing dynamics outlined in the conceptual model in chapter two.

As knowledge creation and sharing is based on mutuality and trust (Alsharo, Gregg and Ramirez, 2017; Pulles and Schiele, 2013) Keystone individuals bring in innovative ideas in order to get innovative ideas back. They are themselves no specialists and not deeply involved into Niche specialists knowledge but they require new ideas brought in by Niche agents. Consequently, they act as knowledge creators on company level but not on network level (NOI-VIII; B1; NNOI-III) bringing in ideas from the network into the organisation. In **Case II** the individual also acts as trust holder for innovative ideas as other agents freely share new ideas with the Keystone agent. That does not work for **Case I** where only little trust develops due to high independencies (NOI-VIII; B1; NNOI-III). Rather than creating knowledge themselves, Keystones act as knowledge and innovation trigger on all levels of interaction. They try to match innovative ideas of other agents in order to derive knowledge relevant for their own company (NOI-X; NNOI-V). Tacit knowledge can only be caught by applied activities, such as interaction, conversation or storytelling (Nonaka, 1994; Grant, 1996b; Zack, 1999). This is considered by the Keystone agent who participated at all project groups and meetings relating to his aim to understand knowledge relevant for his company (B1; B2; AA 1-15) and to avoid knowledge loss through knowledge conversion (Levy, 2011).

Altogether, Keystones rather seek broad and general knowledge for knowledge exploration and for discovering new ideas (Lorenzoni and Baden-Fuller, 1995) as they are not aiming on further specialisation (Dyer and Nobeoka, 2000) but on new knowledge. Still, in order to be informed and be able to act as a knowledge hub, as outlined in the next paragraph, they trigger knowledge creation amongst agents and are to a certain extent themselves involved in the process of creating knowledge. In regard to KS, the activities outlined below are essential for the Keystone to fulfil his role in the BE or network structures. In order to enhance KS, Keystones try to trigger other agents to contribute their knowledge by directly addressing them for their contribution. In **Case II**, being shaped by a higher

informality, the Keystone tries to trigger the interest by addressing the agent's personal interests. This could not be proofed by activities displayed in **Case I** where agents solely acted on a basis of business interests. Both Keystone individuals were particularly open to share business knowledge and the Keystone company supported KS by providing only low KS regularities. Furthermore, the Keystone companies served Keystone individuals or other employees with their company contacts being either based on informal relations such as in **Case II** or more formal relations as in **Case I**. In both cases the company served as a knowledge hub for employees, which also enabled the Keystone individual to serve a knowledge hub in BE or network structures. The Keystone individual connects strategically necessary agents by influencing frequency of interaction and type of interaction among agents. Especially by arguing that not all knowledge shared in all levels of interaction, the Keystone actively influences the platform of interaction the knowledge is shared at, for example on project group or network level. Due to this activities the Keystone has an influence on platform openness (Bordreau, 2010).

Particularly in **Case I**, the Keystone acts also as knowledge protector. The competitive environment as well as the number of competitors in the network require knowledge protection of traditional business unit knowledge (B1; B2), which results in knowledge hold backs (Levy, 2011) and reduces trust building among agents.

Nevertheless, Keystones in both cases try to build up trust among agents, to enhance an informal KS network to facilitate KS (Wulf and Butel, 2017). But whereas in **Case II** the Keystone could easily succeed due to existing friendships (as outlined in network mapping section), the Keystone in **Case I** was not able to influence the development of trust. Especially due to the competitive situation in the network (B1; B2), but also due to the strong connection of Keystone and Dominator (NOI-X) network agents remained restrained with KS. Furthermore, the Keystone in **Case I** tried to use advice relations in the social infrastructure that results out of formal and informal relations (Caimo and Lomi, 2014) as often as possible. This resulted into knowledge retention (Levy, 2011) of other agents. Even though both Keystones invested their own resources and shared knowledge related to new businesses freely,

KS is based on mutuality and reciprocity (Ahuja and Carley, 1999), the Keystone in **Case I** struggled to overcome the retentions on network level. In BE structures these reservations did not occur that strongly, as agents addressed were from completely different sectors (NOI-X). Additionally, more informal than formal relations were existent on BE Level to enhance KS (Batterink et al., 2010), which also means less regulatory power (Isckia, 2009) to get the knowledge needed for the Keystone company.

Not mentioned explicitly as a KM but as a general characteristic impacting KS is the Keystone acting as a network bridge. In order to connect with specialists on generate new knowledge, they bridge (Iyer, Lee and Venkatraman, 2006) their network with other networks in the BE they are located in. In terms of knowledge application, as being seen as knowledge integration (Corsaro, Cantu and Tunisini, 2012) or the building of new knowledge on existing knowledge through knowledge exploitation (Grant and Baden-Fuller, 2004), Keystones show only little activity. Especially for tacit knowledge, knowledge application is essential (Kogut and Zander, 1992; Grant, 1996b). Keystone companies state to be shaper of new technologies and actively engage in the development of and economic innovation force field or an innovation platform. This is supported by the behaviour of Keystone individuals that try to remain close to Niche and big players to enable value creation and innovation implementation. Big players could be possible investors for their ideas (B1; B2; AA1-15). Still, Keystone companies lack innovation implementation as they do not develop learning mechanisms to applicate and integrate knowledge and combine it to innovative ideas. So far, Keystone individuals share their knowledge with the Keystone company head or important employees but do not try to combine the knowledge with knowledge that already exist in the company (B1; B2; AA1-15) by knowledge incorporation. Incorporation requires a certain specialisation (Teece, 2000) but this again reduces the generation of new general knowledge (Dyer and Nobeoka, 2000). Consequently, Keystones in this study did not specialise and their absorptive capacity is not very high (Grant, 1996b). Findings support the mechanisms displayed in the conceptual model in chapter two, **Figure 2.8** and **2.9**. Results show that Keystones access general and broad knowledge while

specialisation and implementation is not focussed at. This also corresponds to the Keystone aim of generating disruptive or radical (Rao, Angelov and Nov, 2006; Henderson and Clark, 1990) innovation, seeking for completely new ideas, to be a shaper of future developments.

Summarising the above, Keystone individual and Keystone company KS activities complement each other. They concentrate on KS, support knowledge creation and lack knowledge application or integration mechanisms. Altogether, KS activities only differ slightly between **Case I** and **Case II**. The main differentiation relates to accessibility and sharing of knowledge through informal relations and trust that is fostered strongly by the Keystone company in **Case II**.

7.3.5 Keystone differentiation

This subsection outlines the results answering **RQ3**, concentrating on the main differences between Keystones in **Case I** and **Case II**. How Keystones differ in detail is marked in **Table 7.17** with a red and bold frame where crosses are set distinctly among the cases. As Keystone analysis was conducted for two cases that are shaped by distinct industry environments and a differing network structure, the differences between the Keystones are displayed and discussed below.

Both cases are shaped by a changing industry. **Case I** is already affected by digitalisation and is highly influenced by changes. Companies in **Case II** are still profiting of a stable industry with a strong competitive environment but also very collaborative cultural aspects. Therefore, **Case I** and **II** are affected by different dynamics and more importantly shaped by different collaborative relations in the networks investigated. Whereas **Case I** is shaped by formal relations and informal relations, **Case II** is shaped by more informal relations due to the collaborative culture of the sports industry. Also, the dependency between companies in **Case I** is higher than in **Case II**, still both cases showed that certain agents are needed to ensure the implementation of new innovative ideas or products.

Interestingly, company attributes or assets, such wealth or size played no significant role. Keystone companies investigated were of different sizes and economic strengths (BD1, 2016; AAD18, 2016; CCD3, 2016; CD3, 2017), therefore not playing a major role in Keystone agent distinction.

Characteristics outlined for analysing the Keystone role are used in this section understand the differences of the keystones. Consequently, **Table 7.8** and **7.9** are a basis for **Table 7.17 - 7.18**.

Results show that Keystones differ slightly on structural and relational, processual and content level.

All characteristics and actions of the Keystone person are shown below in **Table 7.17**.

Dimension characteristics are related to		Keystone person		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
for mal relation	Relational								
	collaboration	collaborative (when personal and company aim is met)	cooperates with everyone in network that follows the same aim, interacts directly with decision makers	x	x	x	x	x	x
		collaborator with network core	collaborates closely with other agents following same aim			x	x	x	x
		not collaborative on traditional business (unit) subjects	does not foster collaboration on traditional business unit	x		x		x	
		interaction/ collaboration hub	tries to connect agents for collaboration			x	x		
		creator of open exchange culture	builds up a familiar network culture build on informal interaction	x	x		x		x
		open communicator	triggers open communication as key to network cohesion; enhances direct interaction		x		x		x
	contacts	contact hub	builds informal and formal relations outside company to enable collaboration, builds informal relations in company to reach aims	x	x	x	x	x	x
		contact broker	thinks strategically what contacts can be shared and what not and only shares contacts on a mutual basis when he gets something back			x			
		contact protector	protects contacts that relate to traditional business unit			x			
		bridge to other networks/ also inside company	pushes cross industry connection by addressing players of other industries to engage in network, seeks connection inside company	x	x	x	x	x	x
		bridge to political contacts	contacts actively political actors to influence developments in network and BE			x	x	x	x
		contact hub for Niche player and big player	balances Niche player and Dominator interest, addresses Niche player and Dominator for collaboration	x	x	x	x	x	x
	social relations	social relation hub/ relates with personalities	enhances direct interaction among agents by matching interests, enhances informal interaction	x	x	x	x	x	x
		social relation with company head	interacts on a personal basis with company head	x					
		social relation with other employees (for strategy execution)	interacts on a personal basis with employees		x				
		social relation with Dominator(s)	interacts on a personal basis with Dominator			x	x	x	x
		heterogeneity trigger of network agents	actively addresses cross industry agents for network				x	x	x
	for mal relation	awareness strong competition	tries to collaborate on BE level with agents that are not based in region to reduce dependency					x	

Dimension characteristics are related to		Keystone person		Context								
				Company level		Network level		BE level				
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II			
Process		awareness of interdependency among network agents due to business interests	tries to position company in network to reduce interdependency and communicates interdependency	x	x	x	x	x	x			
		awareness of formal relation (need for business realisation)	actively tries to build up formal relations for innovation implementation			x	x					
		reluctance on formalising	does not foster to follow any formal guidelines				x					
	Structural											
		relations architect	changes network structures by developing project groups or enhancing cooperation between agents, restructures company structures to reach strategic aims	x	x		x		x	x	x	
		user of network architecture	uses network structures to reach strategic aim, uses direct connection to company head and to employees	x	x		x		x	x	x	
		gatekeeper	decides who can participate to network				x					
		awareness of structures needed for innovation	builds up network structures for more innovative ideas, builds up network structures in company for innovation aim	x	x		x		x	x	x	
		network promoter/ representor in BE	tries to position network in BE, tries to raise awareness in company for BE development							x	x	
		awareness of intra-interorganisational network structures	addresses contacts by using existing network structures	x	x		x		x	x	x	
		proximity to big players and to Niche players	remains close to Niche player to enable value creation remains close to big player to enable innovation implementation, contacts business units needed				x		x	x	x	
	Resource sharing											
	(other than knowledge)	resource matcher/ value sharing hub	matches resources of agents				x		x			
		win creator amongst agents	tries to always find a mutual win				x		x			
		value creation trigger	tries to optimally use resources (expertise of agents)	x	x		x		x	x	x	
		dependent on resource sharing	actively states that challenges faced can only be solved together				x		x			
		resource sharer to reach a strategic aim	engages for company in network to bring in relevant resources	x	x		x					
Knowledge sharing												
	knowledge creator	samples areas in company that require knowledge creation	x	x								
	knowledge filter	filters knowledge for strategic relevance for his company					x					
	knowledge controller	control knowledge that he shares on network level					x					
	knowledge trigger	triggers everyone and tries to get information or knowledge for knowledge areas from agents	x	x		x	x	x		x		
	personal interest trigger for KS	tries to get agents to share knowledge by triggering personal interest		x			x			x		
	knowledge merger	tries to merge/match knowledge by actively addressing agents to certain subjects	x	x								

Dimension characteristics are related to		Keystone person		Context						
				Company level		Network level		BE level		
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II	
		knowledge hub	Individual connects strategically necessary agents by frequent interaction	x	x	x	x	x	x	
		knowledge hub architect	Individual tries to influence frequency of interaction and type of interaction among agents; often needs to trigger interaction			x	x		x	
		information hub	shares information widely and unfiltered	x				x		
		knowledge protector	Individual protects knowledge that belongs to traditional business unit	x		x		x		
		knowledge broker	thinks strategically what knowledge can be shared and what not and only shares knowledge on a mutual basis when he gets something back							
		trust builder for KS	brings others to share innovative ideas by active trust building through mutual idea sharing	x	x	x	x	x	x	
		user of advice relations for KS	when available individual uses advice relations to access and share knowledge (less available in structures that are less formal, less available in BE)	x		x				
		dependent on knowledge shared for strategy execution	actively seeks knowledge for innovative business (unit) ideas			x	x	x		
		social relation architect for KS	tries to enhance informal KS in network and BE				x		x	x
		aware that not every kind of knowledge shared on all level of interaction	knows and communicates that knowledge needs a certain room, general knowledge can be in open structures, specialised knowledge in more closed structures	x	x	x	x	x	x	
		aware that open exchange culture key for KS	knows and communicates that only open communication can enhance KS and innovation						x	
	Change									
		influencer/ lobbyist of relation development	tried to influence the development of relations by actively connecting agents					x	x	x
		awareness company dependency on industry/ environmental changes	scans environment for future changes, discusses future changes in company	x		x	x	x	x	x
		awareness of dependency on big player/governance institution	tries to create independency from big or governmental players by introducing new business ideas	x	x		x	x	x	x
		awareness of industry changes and their impact in BE	tries to influence high impact institution (such as governments) or big players to enable value creation in BE				x	x	x	x
		awareness of dependency on network position	tries to keep position in network, raises understanding in company for resource invest in network in order to keep position	x		x	x	x	x	x
		awareness of network dynamics	observes network dynamics to see future developments				x	x	x	x
		trigger cross industry developments	pushes cross industry connection by addressing players of other industries to engage in network, seeks connection inside company						x	x
		trigger network development	influences network developments by relationship building, KS to prepare for future developments			x	x	x	x	
		trigger political support to enable change	contacts actively political actors to influence developments in network and BE					x	x	

Dimension characteristics are related to		Keystone person		Context							
				Company level		Network level		BE level			
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II		
		adaptability to changes	scans changes in advance and tries to adapt to them	x	x	x	x	x	x		
		openness to new developments (independent from economic situation)	is open to any new developments that could mean innovation				x		x		
	Strategy formation										
		company representor	actively represents company interests in network and outside of network	x	x		x		x	x	x
		awareness of company strategy	knows about company strategy and communicates necessary parts of company strategy for developments	x	x		x		x	x	x
		awareness other agent strategy	informs himself about other agent strategies	x	x		x		x	x	x
		independency trigger	triggers company independency by focussing on innovation development	x	x		x		x	x	x
		company strategy influencer	influences strategy making by closely communicating with relevant company head/employees	x	x		x		x	x	x
		company strategy adapter	by communicating with company head/employees about network developments company strategy is adapted		x		x			x	
		strong strategic outward orientation	concentrates mainly on developments outside of company		x						
		network strategy architect	tries to influence network strategy by relationship building to reach personal/strategic company aim				x		x	x	x
Content	Innovation										
		awareness innovation need to develop new business (unit)	strategically addresses agents to contribute knowledge	x	x		x		X	x	x
		innovative idea developer	Individual brings in innovative ideas in order to get innovative ideas back	x	x						x
		trust holder for innovative ideas	brings others to share innovative ideas by active trust building through mutual idea sharing		x				X		x
		innovation trigger	triggers everyone and tries to get innovative ideas from agents	x	x		x		X	x	x
		innovation enabler/ matcher	matches agents that could develop innovation	x	x		x		X	x	x
		innovation hub	tries to connect agents for innovation development						X		x
		variety trigger	tries to bring in heterogenic partners						X	x	x
		awareness innovation risks	knows that Keystone company alone cannot implement innovative ideas but need Dominator for that							x	x
		economic force field trigger (for innovation)	triggers economic strength in industry by actively addressing agents that could deliver economic strength introduces a joint aim or vision for agents involved							x	x
		Strategic aim									
		influencer company aim in network	constantly adapts to network activities to possibilities in networks keystone needs to also adapt company aim to some degree	x	x		x		X	x	x
		influencer network and BE aim	tries to shape network aim by communicating important	x	x	x	X	x	x		

Dimension characteristics are related to	Keystone person		Context					
			Company level		Network level		BE level	
	Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
		developments in environment to other network agents						
	balancer of strategic interests	tries to balance network agents interests by informing himself actively			x	x	x	x
	aim keeper of strategic interests	tries to keep company aim on network level			x			
Legend: x: Verification in the Case; -: No verification in the Case								

Table 7.17: Differences of Keystone individuals in distinct collaborative relationships

Relating to the results marked in **Table 7.17**, on structural level Keystone individuals show that they differ in their degree of collaboration. Keystone/ **Case I** is only collaborative in regards to the new business unit. He needs to balance KS within the network, due to a strong competitive environment. He is therefore dealing with the paradox of collaboration and competition at the same time (De Wit and Meyer, 2010). The Keystone/**Case II** is open to collaboration on all possible subjects and themes and not influenced by such strong competitive dynamics. In order to protect his contacts as being one possible competitive advantage (Lorenzoni and Baden-Fuller, 1995), the Keystone/**Case I** needs to hold back his contacts and give it away only for mutual sharing. While the Keystone/**Case I** is aware of strong competition and resulting formalities, the Keystone/**Case II** knows that formalisation is needed to build up business relations but is not willing to formalise in any way. Keystone/**Case I** acts as a gatekeeper in the network he is very active in, partly to protect his contacts but also to choose fitting companies and ensure that competition does not increase (B1). The **Case II** individual selects new network members mainly out of sympathy (AA1, 2016). On a processual level, Keystone/**Case I** mainly shares resources to reach a strategic aim on network and BE level. The less control, as on BE and network level, the less resource sharing is used for strategy orientation. Here contact building is important. While this applies for both Keystones, in order to face future challenges, the Keystone/**Case II** often follows his own personal interests on BE level (AA1-15, 2016). As already outlined in the KS section, the Keystone of **Case I** differs mainly due to the protection of business knowledge to the Keystone/**Case II**. He also filters knowledge and controls the knowledge he gives

away to others. The behaviour of Keystone/**Case I** is therefore shaped by knowledge retention (Levy, 2011). On content level, the Keystone/**Case I** keeps the strategic aim into focus on all levels of interaction, while Keystone/**Case II** does not concentrated on the strategic aim reach of the company.

All characteristics and actions of the Keystone company are shown below in **Table 7.18**.

Dimension characteristics are related to		Keystone company		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
Structure	Relational								
		economic dependence of traditional business (unit) on big player	company holds a strong formal relationship with Dominator for traditional business unit	x		x		x	
		economic dependence on other network agents and on public governance financial support	company closely engages with network agents and governmental institutions to finance its business		x		x		x
		openness in network (collaboration) to new (business) ideas	collaborates with every agents that can offer knowledge needed	x	x	x	x	x	x
		open exchange culture in innovative business unit/ company	company enhances employee freedom in innovative business (unit), less hierarchies more open exchange	x	x				
		connected to all type of network agents including competitors	company connects with every agent that follows same interests also competitors			x	x	x	x
		contact hub for Niche player and big player	connects closely with niche and big player to enable and balance value creation and value implementation	x	x	x	x	x	x
		direct connection between management board and Keystone individual and important employee	management board fosters direct interaction with keystone individual	x	x				
		familiar company or business unit culture	company enhances familiar company/business unit culture by enhancing personal interests	x	x				
		very informal company culture	Company does not provide many rules		x				
		openness to cooperation for new business (unit)	company actively seeks cooperation partners for new business unit	x	x	x	x	x	x
		social network in company important	enhances creativity of employees and network agents, enhances personal interest, internal exchange networks are fostered around innovative ideas	x	x				
		well connected to political institutions	company tries to connect to political player by inviting them to events			x	x	x	x
		well connected to Niche players and big players	Niche and big player connection is fostered as Keystone company not a specialist on all areas needed for innovation/ cannot implement			x	x	x	x
	Structural								
		proximity to important customers	company keeps geographical proximity to customers	x		x			
		proximity to big players and Niche players	company keeps close interaction to big players Niche players and considers value creation	x	x	x	x	x	x
		strong formal network structures	builds up relations by fostering business interests			x		x	

Dimension characteristics are related to	Keystone company		Context					
	Characteristics	Actions	Company level		Network level		BE level	
			Case I	Case II	Case I	Case II	Case I	Case II
Process	strong informal network structures	builds up relations by fostering personal interests				x		x
	structural flexibility	adapts to changing environment by restructuring company structures	x	x	x	x	x	x
	strong hierarchical levels	company keeps strong hierarchical levels in traditional business units	x		x			
	lean structures	company enhances lean structures in innovative business (unit)	x	x				
	company structured as SME	even the bigger Keystone company B keeps an SME structure by many small company entities scattered near to core customers	x	x				
	offers personal room for engagement	provides open job specification for employees	x	x				
	Missing formalities	employees want more formality to stick to, feel like loosely connected actors		x				
	Resource sharing							
	value creation trigger	tries to optimally use resources of employees		x	x	x	x	x
	open to additional resource invest in network	company invests resources without knowing return of investment	x	x	x	x	x	x
	open to invest resources without direct benefit	company invests resources without expecting direct benefits		x	x	x	x	x
	Knowledge sharing							
	dependent on complex know-how/technology development	tries to develop innovative technologies to create independency from big players	x		x		x	
	dependency on knowledge for new business development	tries to develop innovative technologies to keep network interesting or create new business ideas	x	x	x	x	x	
	dependency on knowledge to keep creativity as a selling proposition	tries to develop innovative technologies to keep network interesting		x		x		x
	KS trigger / open to KS to gain new business knowledge	company enables employees to engage in network and share knowledge	x	x	x	x		x
	KS platform due to formal and informal contacts	shares knowledge and innovative ideas through formal and informal contacts when strategically relevant	x		x		x	
	KS platform due to informal contacts	shares knowledge and innovative ideas mainly through informal contacts to enhance interaction		x		x		x
	Change							
	adaptability to changes	prepares company and network structures to be adjusted to future developments	x	x	x	x	x	x
	slow internal processes due to dependency on big player	company cannot react as fast as needed in traditional business unit to changing environment	x					
	independency trigger from big player	company enhances innovation that does not relate to big player business	x				x	
	awareness of changes company environment	company tries to react to changes in advance	x	x	x	x	x	x

Dimension characteristics are related to	Keystone company			Context					
		Characteristics	Actions	Company level		Network level		BE level	
				Case I	Case II	Case I	Case II	Case I	Case II
Content		already preparing to future changes	company head wants to be prepared to react to future changes	x	x				
		awareness about industry situation	company head aware that industry needs to change	x					
		openness to new developments only as long as economic pressure not too high	company invests into new developments as long as economic wealth enables them to do so	x					
		shaper of future developments/ trigger of change	companies tries to shape future developments in network/industry by investing resources into network development	x	x	x	x	x	X
	Strategy formation								
		employee flexibility and openness	employees decide within their business area, they are open to new developments	x	x	x	x		
		visionary management board/ head	management board/ head is keen to be ahead industry changes/ developments	x	x				
		direct connection between management board and Keystone individual/ Keystone individual and employees	keystone employees and management board/head foster direct interaction on new business (unit/area)	x	x	x	x	x	X
		Creativity of company main selling preposition	company head communicates that formalities hinder creativity		x				
		clear strategic positioning	company communicates diversification strategy	x		x		x	
		no clear strategic positioning: missing formalities and clear strategic orientation make it hard to keep customers long term	company communicates no clear strategy but company head enhances diversification		x		x		X
		balancer strategic interest	Company balances own strategic interests and agent interests to succeed with network engagement by constant adaption to developments	x	x	x	x	x	X
		clear company aim/vision existent	company aim/vision are communicated inside and outside the company	x	x	x	x	x	X
	Innovation								
		investor in new technologies (when industry stable)	company communicates to invest into new technologies as long as resources available	x					
		innovation trigger	communicates interest in new innovation development	x	x	x	x	x	X
		proximity to customers enables innovation development	enhances proximity to customers to enable innovation implementation	x		x			
		shaper of new technologies	engagement in development of innovation force field or innovation platform enables company to be shaper of new technologies	x	x	x	x	x	X
		lack of innovation implementation	lacks learning mechanisms to applicate and integrate knowledge and combine it to innovative ideas	x	x	x	x	x	X
		awareness of innovation need to create independency	company enhances room for employee engagement to enable them to develop innovative ideas, be creative; company engages in the development of a force field for innovation	x	x	x	x	x	X

Dimension characteristics are related to		Keystone company		Context					
				Company level		Network level		BE level	
		Characteristics	Actions	Case I	Case II	Case I	Case II	Case I	Case II
Strategic aim		innovation topic used to keep agents in network	Keystone communicates innovation as shared vision			x	x		
		innovation needed to keep network interesting	Keystone communicates innovation interest to keep network together			x	x		
		shaper of the future	company communicates that it aims to a shaper of the future and does not want to react to developments only	x	x	x	x	x	x
		diversification of company products	company enhances product diversification	x	x			x	
		awareness that homogeneous structures do not allow diversification	company fosters heterogeneous partnerships			x	x	x	x
		aims to reach relational independence (of new business unit in BE)	company constantly seeks for new partnerships	x	x	x	x	x	x
		company head follow personal interest and company interest	company head follows personal interest and company interest	x	x				
		influencer network and BE aim	tries to shape network aim to serve strategic interests of company	x		x	x	x	x
Legend: x: Verification in the Case; -: No verification in the Case									

Table 7.18: Differences of Keystone companies in distinct collaborative relationships

Findings related to the structural dimension on company level, as stated in **Table 7.18**, show that strong competition resulting into formal relations have a clear influence on strategic orientation and therefore on Keystone behaviour in **Case I** and **Case II**. Informal relations shape the collaborative relations of **Case II** and this informality is visible on all levels of interaction. Informal relationships, often based on friendship, were also confirmed by network mapping. Consequently, the Keystone company in **Case II** is also shaped by a lack of strategic orientation, formal processes and structures. The lack of formally prescribed aims and positions lead to a constant adaption of company and network aims and a high resource invest and result in a certain request of formality by Keystone company employees. The informality in **Case II** leads to an informal company culture with less formally prescribed positions (Grant and Baden-Fuller, 2004; Krackhardt and Hanson, 1993).

Keystone/**Case I**, although the Keystone is influenced by a collaborative company culture and by an internal network of exchange, is still shaped more by formal rules of interaction and formal structures than Keystone/**Case II**. As shaped by a certain formality, trust is important but hard to develop, due

to strong competition (Ahuja, 2000). Because of the friendships maintained, trust is very important for Keystone/**Case II**.

On processual level, related to KS activities, surprisingly little difference can be explored between the cases except the strong use of informal structures in **Case II** and the knowledge retention and protection of the Keystone in **Case I**. Formal governance mechanisms play a greater role in **Case I**. Here the Keystone tends to control knowledge by formal rules of interaction following a clear strategic aim. This enables the Keystone to consciously influence other network agents in a more strategic way using distinct governance mechanisms than informal relations (Rowley, Behrens and Krackhardt, 2000), as displayed in **Figure 2.8 and 2.9**. Due to the strong competition in **Case I**, trust building and KS is difficult, especially when certain control mechanisms are used (Roffe, 1999). Still, simultaneous competition can also lead to ecosystem innovation and development (Zahra and Nambisan, 2012). In contrast to that, the Keystone/**Case II** is able to maintain very strong informal political relations, based on informalities, enabling a great impact outside of the investigated network structures. Nevertheless, missing formalities also lead to a problem of balancing company openness and business model configuration for Keystone/**Case II**, as well as keeping strategic aims, as shown on the content level. This is because informal ways of interaction and communication can often not be transferred to formal business relationships. Summarising Keystone differences, they can be distinguished by strategic orientation, way of KS, formal and informal culture and their ability to influence their network due to the existing structures in the network.

7.3.6 Summary

This chapter provides a holistic approach to understand the Keystone role. Having described actor characteristics and actions by relating them to distinct role dimensions, the Keystone was addressed in a structured way. Keystones KM and KS actions and a differentiation of the Keystone agent in distinct CR were provided. How the research questions are answered in detail by the findings stated, and how they can be understood in a wider context, is discussed in the next sections.

8. Discussion

8.1 Introduction

This chapter discusses main findings and implications of research related to a broader context. A holistic view of the study is provided linking all of its parts together, as well as a critical discussion of major findings. Every section of this chapter introduces main implications derived from the findings and subsequently discusses these implications further.

Figure 8.1 shows how the study started by reviewing the literature and continued with the development of a conceptual model to understand main interrelations. Together with the empirical analysis these steps structured the result display. The literature review focused on major research streams explaining necessary dynamics to understand the Keystone role within its environment. The understanding derived from the literature review was combined to developing a conceptual model, which supported the understanding of Keystones in their environment, essential for the empirical analysis, the result display and the discussion of findings.

Study results showed that aspects describing the Keystone role in its environment of CR, mentioned previously by other authors, can be supported by the findings of this study. Additionally, and even more importantly, the Keystone role could be analysed and described in a more fine-grained way and more structured than previous studies did. Even more so, as former works often introduced a conceptual description of Keystones rather than an empirical study as provided here.

The multilevel research approach taken in this study, providing an explorative and qualitative study of the Keystone within its environment, is also a novelty in BE research. By using network research aspects and linking them to BEs, and by exploring single actor specifics in CR, this investigation enables a holistic understanding of the Keystone role. The qualitative and explorative approach has proved to be useful in enhancing the understanding of the phenomenon investigated. However, the study also suggests improvements in the investigation of the Keystone by laying a greater emphasis on relations the Keystone maintains, the interdependencies resulting from these relations and how these

aspects influence the Keystone characteristics. Furthermore, in the future a stronger emphasis should be taken on the interplay between individual and company to better understand the Keystone agent from that mutual perspective.

In the following, the research conducted will be discussed as well as the research findings. The latter are structured as the findings, displayed in chapter seven, by considering the structure of the research questions and the constructs developed to answer the research questions.

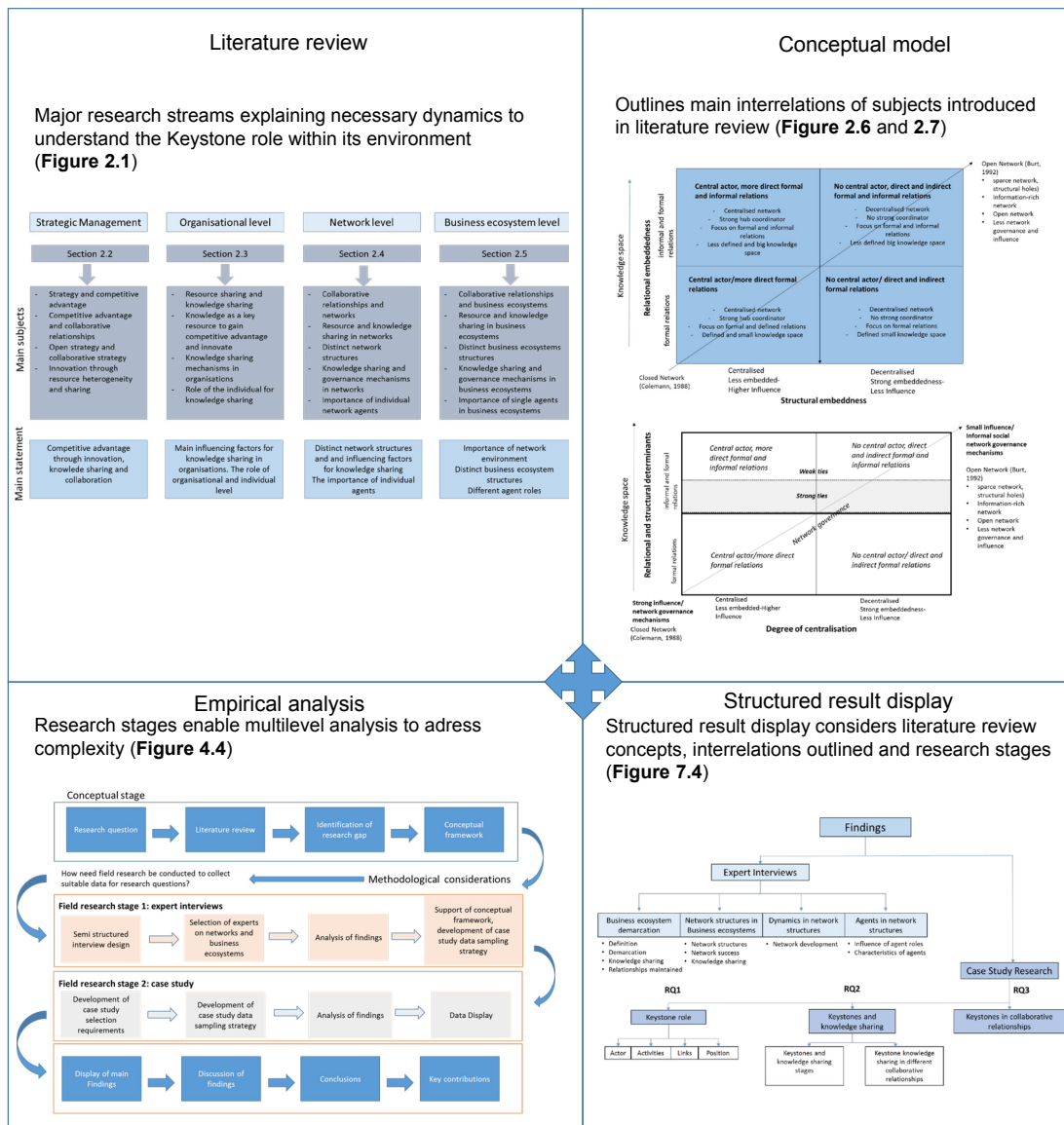


Figure 8.1: Research process and stages

8.2 Discussion on research conducted

First of all, theoretical and methodological implications of this study are outlined. After that the research findings are discussed in detail.

8.2.1 Theoretical implications

This thesis reveals two main theoretical implications for the combination of theoretical constructs, referring to existing theoretical concepts and their combination with BE research.

a.) This study suggests a combination of existing theoretical concepts with BE research. For BE level, the study provides the combination of aspects of network research, the RBV and the KBV to explain CR as the environment of Keystones. On the agent level, the study considered concepts from organisational and SM theory to investigate the Keystone on organisational and individual level. By linking these existing theoretical concepts to BE theory, being a relatively new construct, the explanatory power of the research is improved. Here, concepts are linked together that have not previously considered in this combination. This way, the study also enables the investigation of the BE concept in the context of business networks rather than in front of a technological background.

b.) Furthermore, the study provides a finer-grained understanding of the aforementioned combinations by considering the holistic investigation of the concepts outlined in the literature review. These theoretical implications are discussed in the following in more detail.

BE theory as a relatively new concept (Scaringella and Radziwon, 2017) offers a great potential for gaining new knowledge in SM, especially as it has rarely been systematically linked to existing theoretical concepts so far. BE theory can contribute to network theory by considering environmental aspects, seeing networks in a bigger context. Environmental changes such as BE evolution or attributes of the environment, being stable or less stable, as well as the importance of certain agents (Peltoniemi, Vuori and Laihonon, 2005; Adner and Kapoor, 2010; Rong et al., 2013; Rong and Shi, 2015; Shang, 2014) are new to network research.

This study matches these ideas of BEs to network structures and enables the advancement of research on business networks. Furthermore, BE theory currently concentrates mainly on subjects such as environmental dynamics as well as technological platforms (Isckia, 2009; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012). Seeing BEs from an innovation and business network perspective, as provided in this study, the use of network research concepts as well as other concepts and theories that relate to business organisations is possible. Additionally, network theory contributes to ecosystem theory by explaining how actors are related to each other and how relations are built up (Iansiti and Levien, 2004a; Rong et al., 2015). Relating this knowledge to BE theory is a new approach that is just evolving further (Wulf and Butel, 2017).

Supply chain management research has been linked to BE theory in the past, being a form of network research considering strong relationship dependencies among actors for production issues (Rong et al., 2015; Rong and Shi, 2015). Still, research on distinct network relations and their dynamics remain underrepresented in BE research so far, and is investigated towards a first understanding in this study. How certain agents interact, what agent roles can be identified and what influences their interaction and exchange, such as resource sharing or KS, is another field addressed by this study. Here, the agent in his environment was investigated. Even though certain BE agents are described by other researchers, they mainly relate back to Iansiti and Levien's (2004a; 2004b) introduction on BE agents. In order to understand what is important on agent level to fulfil an agent role, the organisational as well as the individual perspective needs to be understood. Here, the consideration of strategic aspects, such as strategic actions as well as resource and KS to reach strategic aims start to matter and were subject of investigation in this study. Therefore this study contributes to a theoretical advancement in BE research as the Keystone has not been related to strategic actions in order to understand his business context and the role he fulfils so far.

Summarising the above, this study offers a combination of the above described concepts to better understand the Keystone role. It agrees with current studies on BEs, seeing BE theory as an important construct to explain agents in business environments. It also supports the need for more investigation

on agent level as well as the combination of existing constructs with BE theory. The research conducted enables a finer-grained understanding of how these concepts can build on each other by combining them on different levels of investigation, but also by considering different research perspectives. Here, methodological considerations come into play as outlined in the next section.

8.2.2 Empirical implications

This thesis raises three main empirical implications for the study of Keystones in BEs.

a.) The study offers a structured approach of Keystone investigation. Unlike previous studies mainly building on one central work relating to Keystones, here the Keystone agent is investigated by considering theoretical adjacent constructs as outlined above. Furthermore, this study uses a structured approach to investigation based on a conceptual model, a conceptual research framework and a comprehensive literature review.

b.) The study provides a multilevel and therefore holistic analysis of the Keystone. Different levels of analysis refer to the Keystone agent as the subject of investigation being the BE, network, organisational and individual level. The Keystone agent itself is seen as consisting of individual and organisational characteristics at the same time.

c.) The study explores the Keystone agent by using a multimethod analysis as well as a new method related to network research. By applying a variety of different methods to understand the Keystone role in its environment, a solid data foundation was reached that meets the complexity of this research approach.

The investigation of the Keystone agent is still an underrepresented research area (Scaringella and Radziwon, 2017). Former studies relate mainly to the central work introduced by Iansiti and Levien (2004a) that describes the Keystone agent on the basis of Moore's (1992; 1996) work. Some studies refer to certain aspects of the Keystone such as his strategy (Stead and Stead, 2013) or the way he manages platforms (Isckia, 2009). Studies related to the Keystone are overall quite scattered and no holistic approach in understanding the Keystone role is offered. This study offers a new structured

approach of Keystone investigation by using a conceptual model showing main interrelations of existing concepts as well as a conceptual research framework using a holistic perspective on research in SM and BE theory. De Wit and Meyer (2010) introduced four different dimensions, being structure, process, content and context in order to understand SM subjects by considering different angles of contemplation. De Wit and Meyer's (2010) dimensions are at the basis for the conceptual research framework (**Figure 3.3, 7.1**) and support this study to understand the Keystone in his environment. The conceptual research framework helps to structure findings on different levels of investigation. Additional to that dimensions, the Keystone itself is investigated in a structured way in this study by using Adner's (2017) concept of BE investigation for examination of the Keystone. Consequently, this thesis agrees with studies outlining the importance of the Keystone role (Iansiti and Levien, 2004a; Stead and Stead, 2013). The research questions and their findings related to the structured investigation of the Keystone agent are outlined further below.

Due to Keystone research complexity investigating agents operating in a network of CR (Wulf and Butel, 2017), a multilevel analysis is necessary to ensure the holistic view on the Keystone agent. Former studies provide mainly descriptive or conceptual (Scaringella and Radziwon, 2017) and only few empirical investigations (Isckia, 2009; Kang and Downing, 2015). Additional to that, empirical investigations do not consider the importance of a multilevel perspective. In this study, the multilevel perspective taken enables to investigate the Keystone agent not only on BE level, but also on network and organisation level. Even more so, it offers a new perspective of the agent itself building on Moore's (1996) notion that the Keystone agent is the individual and the company at the same time. Therefore, the Keystone agent is characterised on individual level and organisational level while considering his interactions on different levels of CR. In order to meet that complexity, the choice of suitable methods is essential (Saunders, Lewis and Thornhill, 2012).

The methods selected for this study relate to methods for qualitative, explorative and very complex contexts (Easterby-Smith, Thorpe and Jackson, 2015). The combination of methods is a novelty to investigate the Keystone, nevertheless, mainly traditional qualitative methods were used. The

methods were selected by their ability to contribute to the different dimensions (De Wit and Meyer, 2010), as well as their suitability for different levels of investigation. Additional to that, a new method was developed by using the network mapping method as part of SNA in a qualitative context. The method was adapted to a qualitative context in order to help analysing specifics characterising the single agents rather than the network itself. This supports Berthod, Grothe-Hammer and Sydow's (2017) view, who state the importance of the single actor within networks. Schatzki (2011), who emphasises that small phenomena are important to understand larger phenomena, underlines the importance of smaller bundles of practises rather than larger bundles. This also supports the view that it is important to understand types of agents in networks to understand them in a bigger system such as the BE (Butel, 2014; Schatzki, 2011).

8.3 Discussion on research questions

In this section the research questions, as well as the main findings related to them, are outlined. As this research analyses the Keystone role, this chapter discusses major findings to substantiate the research conducted. The following research questions were asked:

RQ1: How can Keystone role similarities within more formal and more informal collaborative relationships be described?

RQ2: How do Keystones manage and in particular share knowledge?

RQ3: How do Keystones differ in more formal and more informal collaborative relationships?

The first research question relates to the aim of a structured description of the Keystone role, which has not been provided so far. Therefore, a theoretical construct analysing the Keystone role is displayed in this research, referring to its characteristics and actions, as well as to the Keystone strategy, its positions and links maintained, following the work of Adner (2017) on analysing BEs. Research question two relates to a central element of the Keystone role, its KS activities, which has been already stressed by other studies in an innovation context (Sawhney and Nambisan, 2007; Zahra and Nambisan, 2012) but not related to the Keystone role. Research question number three

emphasises the Keystone within its environment and the possibility that Keystones differ depending on the environment they act in. Major findings related to these research questions are outlined in the following.

8.3.1 Description of the Keystone role

By analysing the Keystone within its complex environment, using a multimethod as well as a multi-level approach, the research questions could be answered sufficiently. Focussing on the first research question, this section outlines the Keystone role by listing main implications derived for the characteristics of the Keystone, his strategy and his position and links maintained.

8.3.1.1 Keystone characteristics

This thesis provides three main implications for the study of Keystone characteristics as part of the Keystone role. Only major findings are outlined here to contrast novel approaches to existing work. Detailed findings are listed in chapter seven.

- a) This study supports certain Keystone characteristics already introduced by former conceptual and empirical research on Keystones, while explicitly displaying characteristics that not have been discovered so far.
- b) Building on appropriate assumptions and research criteria, this study provides a more fine-grained understanding of Keystone characteristics relating it to different levels of interaction.
- c.) This study challenges the current view on Keystone characteristics by conducting a multilevel analysis on individual and company level.

In the following, all three implications are outlined further. Supporting main characteristics outlined by former conceptual and empirical studies, this study found that a Keystone acts as a platform leader (Zahra and Nambisan, 2012) that tries to maintain the ecosystem health (Iansiti and Levien, 2004b) and that influences co-evolution among other agents (Mäkinen and Dedehayir, 2012). In order to be able to act as a platform leader, maintain the ecosystem health and co-evolve with other agents, the Keystone needs to be collaborative and a contact hub. Other than in former studies, characteristics

are analysed on different levels of interaction showing that they differ depending on Keystone engagement on organisation, network or BE level. Furthermore, additional characteristics could be identified that are all supported by a coherent action undertaken by the Keystone. **Table 7.10** in the findings section supports the notion that the Keystone is a platform leader and additionally provides details referring to Keystone individual and company characteristics. **Table 7.10** builds summarised characteristics based on **Table 7.8** and **7.9**. This way, the findings section provides a comprehensive view on Keystone characteristics and actions that support and complete existing Keystone specifics. Additionally, characteristics and coherent actions are related to different levels of interaction in order to understand what Keystone characteristics are visible on all levels, therefore being strong characteristics.

As mentioned above, this study challenges the current view on Keystone characteristics by conducting a multilevel analysis on individual and company level. Former studies did not consider the individual and the organisational level to understand the agent role, even though Moore (1996) suggested the importance of both. Results showed that individual and company interests of Keystones need to be aligned in order to ensure Keystone activity on organisation, network or BE level. This can be a personal or strategic interest that overlaps. Also trust between the company and the individual is essential to enable this interest alignment (Hosmer, 1995). The connection between Keystone individual and Keystone organisation, meaning the company head for example, is maintained by an informal KS network inside the organisation, which enables a direct connection to decision makers and decision contributors such as other employees. These interdependencies that are the basis for a Keystone agents to evolve and be active in a network of CR, are a novelty to BE research. This also holds potential for future work.

8.3.1.2 Keystone strategy

This thesis demonstrates four main implications for the study of Keystone strategy as part of the Keystone role.

a.) This study explores a new dimension of Keystone research, the strategy a Keystone follows. So far, the term strategy and role are used interchangeably in former Keystone publications. By applying a complex theoretic approach allocating strategic actions to a holistic concept of investigation, the Keystone strategy is likely to solve previous research inconsistencies, seeing strategy as being equivalent to the role. Here, Keystone strategy is identified as being an important part of the Keystone role.

b.) This research suggests the consideration of the strategy as practise approach, understanding individual strategic action undertaken by the Keystone agent as well as the interplay between individual and company for strategy making.

c.) The study provides a more refined understanding of strategy type followed by the Keystone agent. As already suggested in the literature review, but not investigated in Keystone research so far, the Keystone agent is likely to follow an open or collaborative strategy in order to reach innovation and competitive advantage. Beside that new approach towards Keystone strategy, this study also implicates how they balance their strategy on different levels of interaction and how they use platform management to do so.

d.) This study additionally implicates that the Keystone need to collaborate with others to follow the strategy aimed at and to create an impact in different types of CR. They collaborate closely with certain other network agents building a network core that could consist of other Keystones or a Dominator. Research results demonstrate that Keystones are not acting in isolation.

All four implications are outlined further below. This study supports the notion that, in order to fulfil their strategy, Keystones need to have certain abilities (Iansiti and Levien, 2004a; Sawhney and Nambisan, 2007). Here, characteristics and actions of Keystone are the foundation to fulfil the Keystone strategy and reach Keystone aims on different level of interactions. By concentrating mainly on actions that Keystone individuals follow, supported by their company as displayed in the findings section, a strategy as practise approach was taken (Eisenhardt and Graebner, 2007). The compatibility of the research as practise approach is proven by the relevance of strategic individual

action as well as the awareness of the individual of his own relevance. Supporting Jarzabkowski (2005) by seeking theories that bring human actions back into focus, this study underlines the pertinence of individual action under consideration of company specifics. Furthermore, this work offers a refined understanding of Keystone strategy as being an open and collaborative strategy.

In response to the Keystones offering platforms of interactions (Iansiti and Levien, 2004a; Den Hartigh, Tol and Visscher, 2006), findings show that they not only offer platforms but strategically manage them in order to profit from collaboration. This supports the view that strategies need to integrate external relations collaboratively to enhance mutual resource and KS (Saebi and Foss, 2015). Former studies state that Keystones follow a value creation strategy (Iansiti and Levien, 2004c; Moore, 1993; Cusumano and Gawer, 2002; Tiwana, Konsynski and Bush, 2010; Mäkinen and Dedehayir, 2012) stressing that this strategy does not follow altruistic reasons. In response to this concern, the current study found that the reason why Keystones engage is that they need to further develop their own business and gain knowledge for new business areas.

This research finding is consistent with the need for new knowledge in uncertain and changing environments (March, 1991), where diversification can enhance flexibility and adaptability (Matusik and Fitza, 2012) as well as reduce dependency. Based on the above, substantiation motives for Keystones to follow their strategy are provided, as well as a relation of the findings towards existing concepts of organisation theory.

Furthermore, the above stated implicates that Keystones need to closely collaborate with others, by forming a network and a network core, being even closer in collaboration determined by a higher frequency of interaction. Knowledge about collaboration is consistent with the view other researchers follow. Collaboration means working towards a common goal (Martinez-Moyano, 2006) in order share resources and enable to develop a more diverse set of knowledge (Brass et al., 2004; Zheng, Zhang and Du, 2011) and the development of innovative ideas (Leonard-Barton, 1995; Dyer and Nobeoka, 2000; Ahuja, 2000; Kodama, 2007; Lorenzoni and Baden-Fuller, 1995). This study supports this view, finding that Keystones try to influence actively the joint aim development under

consideration of their own aims. Keystones in both cases understood that collaboration is essential in order to meet the future challenges of their industry.

8.3.1.3 Keystone position and links

This thesis raises four main implications for the study of Keystone positions and links as part of the Keystone role.

a.) This study explores an often mentioned research dimension of existing Keystone research and corrects the assumption about Keystone centrality in network structures.

b.) This study provides a finer-grained understanding of the Keystone position and the links maintained as well as the influence the Keystone has on these relations.

As in the previous sections these implications are further outlined below.

So far, research on BEs sees Keystones as central or focal firms and as drivers of network developments (Iansiti and Levien 2004a; Adner and Kapoor, 2010; Gawer and Cusumano, 2014; Rong and Shi, 2015). They are conscious about their position and their ability to influence other network agents (Dhanarag and Parkhe, 2006). Often Keystones are also called orchestrators or hub firms (Scott, 2017; Iyer, Lee and Venkatraman, 2006) implying that they are in a central position maintaining a high number of links. This position again enables the alignment of own company aims to network aims (Moore, 1993; 1996; Sawhney and Nambisan, 2007; Zahra and Nambisan, 2012). The contributions of this study strengthen the above arguments. Nevertheless, this study enables a more fine-grained understanding of the Keystone position and links maintained. Results show that Keystones are not automatically located in the centre of network relations. The types of relations need to be understood first in order to verify the Keystone position. The study conducted here revealed that Keystones are located in the centre of relations based on frequent interactions but not in the centre of business relations. This again confirms the Keystone's ability to build up a platform of interaction. Additional to that, the study provides an understanding that the position of the Keystone alone cannot enable the orchestration of a platform of interaction. Keystone researchers state that due to the high

number of links maintained (Adner and Kapoor, 2010; Partanen and Möller, 2012; Battistella et al., 2013; Shang, 2014), Keystone can decide if they play a Dominator, Keystone or Niche player role. In contrast to that, this research stresses that the role of the Keystone is not only dependent on his position but also on his environmental and BE constraints being dependency and uncertainty in the system. Depending on these environmental aspects he might be in a central position of informal relations, but he does not have the economic power to dominate the system nor the expertise to be a specialist. As the size of the Keystone is relatively small in comparison to other firms in the system (Iansiti and Levien, 2004a; Mäkinen and Dedehayir, 2012), he is dependent himself on the value created and cannot chose to dominate the system, as this would stop value creation. In addition to that, research found that Keystones are embedded in a core of strong ties and a high number of weak ties that they balance in order to gain new knowledge.

Consequently, Keystones balance and influence their relations to a great extent. Here, the study provides new insights on how Keystones influence the agents they collaborate with. Keystones try to consciously influence network relations to reach their company aim. They constantly adapt to BE developments but also try to shape and influence these developments actively. Depending on the level of interaction, they have different abilities to influence, with stronger mechanisms on company level and less strong mechanisms, such as more informal than formal relations, on BE level. In contrast to the term orchestrator (Sawhney and Nambisan, 2007; Li and Garnsey, 2014), Keystones cannot completely control, even though they might try to, govern or orchestrate BEs but only trigger developments. Additional to that, Keystones need to balance relations they maintain by providing a platform of interaction. They poise the proximity to big players in order to monitor industry and BE developments and ensure innovation implementation and the relation to specialists that do not want to give away their knowledge to big players. The maintenance of relations towards big players, such as Dominators and Niche players, can be revealed as being an important task of the Keystone.

Most of the time, Keystones balance competition by platform access regulation, ensuring that no competitors could enter the network of CR to not change dynamics. They also try to influence contact

making and how relationships are built up, enhancing informal exchange to enable KS among members.

8.3.2 Keystones managing and sharing knowledge

Whereas the above sections discussed research question number one, this section is related to research question two. Two main implications for the study of Keystone managing and sharing knowledge can be derived.

a.) The study supports the importance of KM and KS for the Keystone as well as the significance of the Keystone for KS in BEs.

b.) Research conducted provides a finer-grained understanding of Keystone's KM and KS processes as well as a structured approach towards the investigation of these processes.

Supporting the studies seeing KM as being one of the most important tasks to enable BE development (Gastaldi and Corso, 2016; Iansiti and Levien, 2004a), the study shows that KS is a central tasks for the Keystone to provide a platform and enable interaction and value creation. As they have a collaborative approach on their platforms, they need to enable KS to support their open strategy. The view on Keystones as knowledge hubs to enable KS is not new (Iyer, Lee and Venkatraman, 2006) and the argument is also endorsed by findings of this study. As knowledge hubs, Keystones try to govern their CR in order to reach their aims and be able to react to future changes and shape developments. As new knowledge is needed for developing innovative ideas for new business development, the aim is to enhance innovation development. Depending on informal rather than formal relations to enhance KS, Keystones have less regulatory power the less they can influence interaction. Meaning that their influence ceases from network to BE level but is still high in comparison to other actors. This is mainly due to the important connections and contacts they have, serving also as bridge to other networks (McEvily and Zaheer, 1999).

Furthermore, the Keystone is important to enhance and steer KS in BEs. He triggers the contributions of other agents, therefore is considered in this study to be a knowledge trigger. This relates directly

to the Keystone and the KM process consisting of distinct KM steps (Liu et al., 2014; Grant, 1996a; Spender, 1992). Overall, Keystones are good in knowledge triggering and creation but weak in learning and incorporation and consequently poor in innovation implementation. They need to invest a lot of resources into the platform creation and management in order to enable the variety of agents and knowledge and to enable mutuality (Alsharo, Gregg and Ramirez, 2017). They need to balance heterogeneity and aim orientation to ensure relevant KS. Furthermore, they try to enhance specialists' contributions in order to enable new value creation and knowledge creation. They also need to integrate Dominator interests, as Dominators are essential for innovation realisation. Additional to that, they connect and bridge (Iyer, Lee and Venkatraman, 2006) to other networks within the BE to align developments.

8.3.3 Keystones in distinct collaborative structures

This section is related to research question number three. Two main implications for the study of Keystones acting in distinct collaborative structures were derived from this research.

a.) The study offers a novel approach on investigating Keystones by using a multiple case study approach in order to differentiate between distinct collaborative structures Keystones act in. This was done to enable a distinction between Keystones in differing CR.

b.) Investigation revealed that Keystones do not differ to a great extent when operating in distinct CR. Most of the differences could be related to the environmental circumstances they are situated in, being formed by more informal or formal relationships.

A novel approach is taken in this study by investigating Keystones using multiple case study method taking place in distinct CR. CR in **Case I** are shaped by a higher formality due to environmental constraints, such as high-velocity changes, uncertainty and dependency. **Case II** is influenced by an informal culture of interaction, being situated in a more stable and less fast changing industry. The cases were chosen to be opposed to each other in order to enable a differentiation between the Keystones. Interestingly, Keystones investigated show surprising similarities even though they were

in different environments, which contributes to the understanding of research question one. Differences found, could be related back to the environments they are based in being influenced by informality and formality, contributing to research question three. Keystones in **Case I** are dealing with the challenge of a formalised environment and struggle with openness and access to their platform of interaction as well as knowledge, due to existing constraints such as interdependencies and knowledge hold backs. In contrast, in **Case II**, where competition is existent but the environment not as fast changing as in **Case I**, Keystones easily enable collaboration among agents but struggle in creating business for their own company. This is probably due to the reluctance on formalising informal relationships to some extent, to enable the evolvement of a more formal business relationship. Still, this informal way of interaction triggered by the Keystone in **Case II** also leads to an easier evolvement of trust and KS. Case study findings reveal that Keystones fostering informal relations have a higher influence on BE development as they need informal relations to influence actors in environments with less direct interaction.

8.4 Summary

This chapter discussed the major findings revealed by the study conducted. A structured approach of Keystone agent investigation was provided and outlined in detail as well as his importance on KM and his differences in distinct CR. Altogether, this chapter highlights the impact of the Keystone role for BE and network dynamics and enables a more detailed understanding of the role's attributes. This also underlines the importance of conducting further research in this area contributing not only to the field of BE research, but also to adjacent theoretical concepts proving their validity and correctness even further.

9. Conclusion

9.1 Introduction

This research has aimed at shedding light into the Keystone role in CR. Characteristics and actions as basis for describing the Keystone role have been explored. Additional to that, Keystone KM and KS activities have been outlined as well as differences between keystones in distinct CR.

In order to address these aims, three research questions have been developed that were comprehensively discussed in the discussion chapter. These questions are outlined briefly here in order to draw conclusions on the complete study. Additionally, key contributions are discussed, as well as limitations and an outlook on future research.

9.2 Answering the research questions

This subsection shows how the research question were answered, the processual perspective of answering the research question and the actual answers to the questions. As shown in **Figure 9.1**, research questions were aiming at different levels of interaction in address the outlined research gap. To understand the Keystone from a multilevel perspective, the individual acting on network level was the starting point and was then linked to all levels of interaction. As displayed in **Figure 9.1**, the research questions were answered by considering all levels of interaction of the Keystone agent. These levels were then used again in the findings presentation.

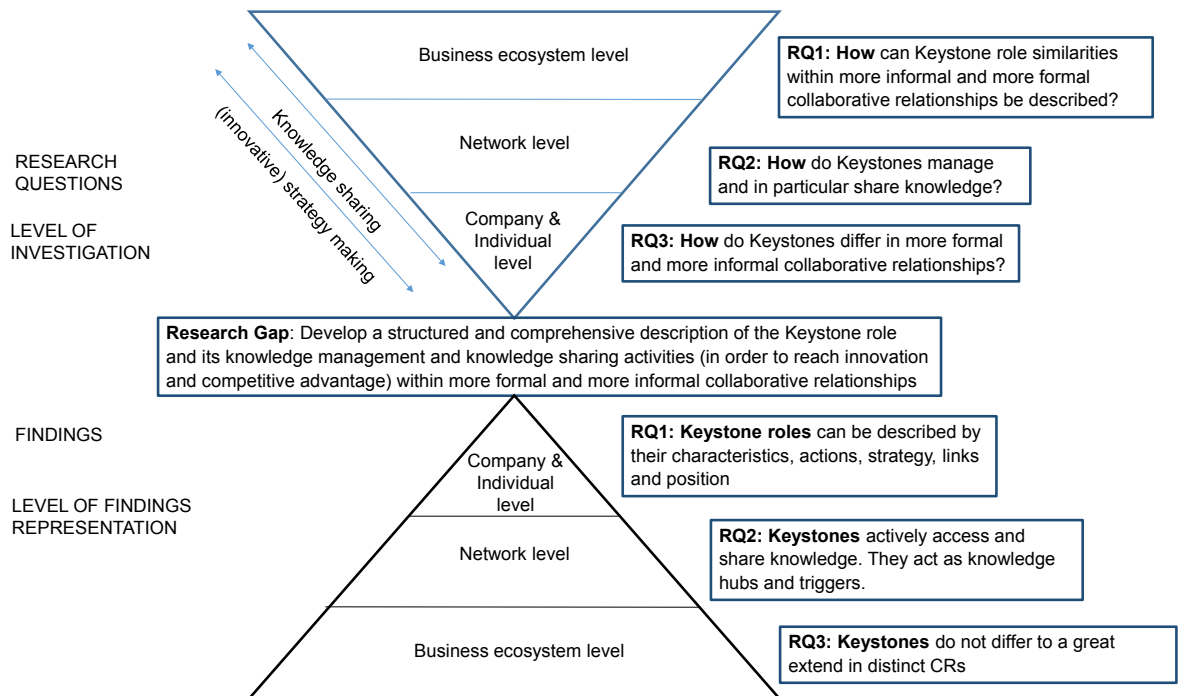


Figure 9.1: Research questions and answers from a multilevel analysis perspective

The research process to enable the answering of the research question is outlined in **Figure 9.2**. After a development phase, the research gap was identified as a basis for the research questions. In the methodology and data collection chapter the research questions were used to guide methodological considerations and the process of data collection. For chapter seven and eight, a structured data display was necessary and the research questions served again as a structuring element in order to be able to logically arrange the answers to the research questions. This structure has also been kept for the discussion chapter. Consequently, the research process was guided all way through to be able to answer the research questions.

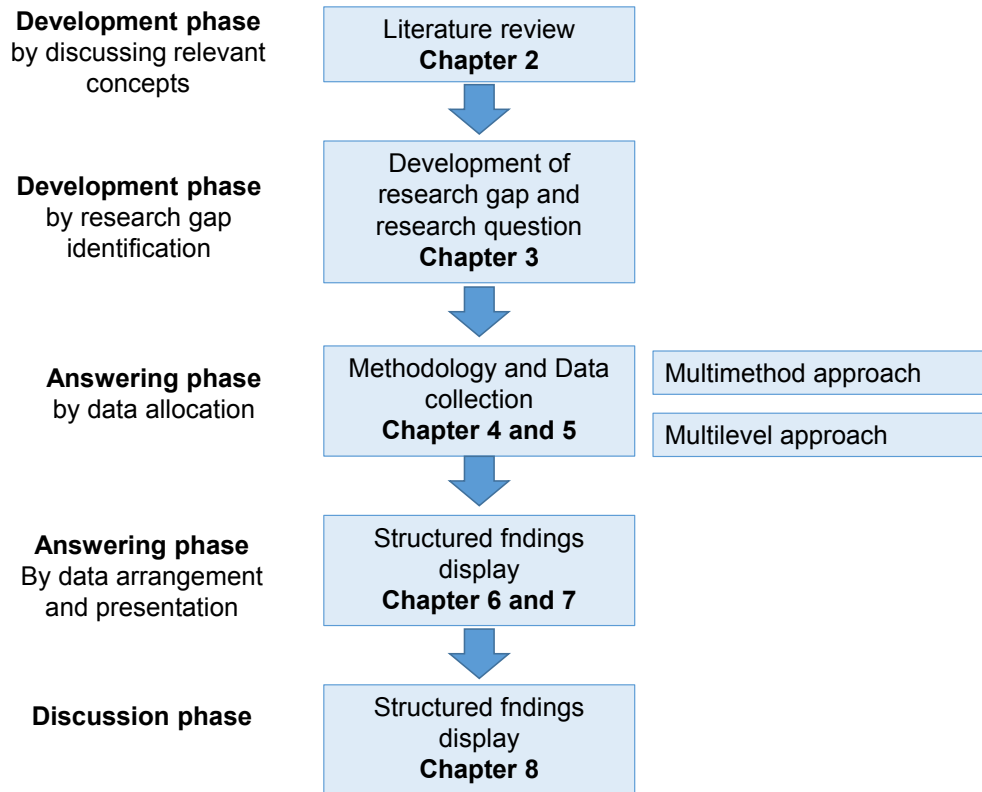


Figure 9.2: Processual perspective of answering the research question

The main research questions and their answers are outlined briefly below in **Table 9.1**. After that some important general findings are discussed.

Research questions and implications of this study	
Research question	Implications
RQ1: How can Keystone role similarities within more formal and more informal collaborative relationships be described?	<p>As outlined in findings and discussion section:</p> <ul style="list-style-type: none"> - Keystone consists of characteristics and actions that describe their role and that can be allocated to their strategy - Keystones are individual and organisation simultaneously acting in the network - Keystone individuals need a direct connection to decision makers in their organisation - The Keystone role is determined by strategy, position and links <p>Strategy</p> <ul style="list-style-type: none"> - The Keystone individual is essential to undertake strategic action - Keystones follow a collaborative or open strategy - Keystones need to collaborate to reach their strategic aim

Research questions and implications of this study	
Research question	Implications
	<p>Links and Position</p> <ul style="list-style-type: none"> - Links maintained and position taken in CR can be explained by characteristics and actions and are part of the Keystone role - Keystones are not necessarily in a central network position - Keystone collaborate in a network core of strong relations - Keystones maintain a high number of informal and weak ties - Keystones balance their influence and relations consciously - They balance competition and collaboration on a platform of interaction
RQ2: How do Keystones manage and in particular share knowledge?	<ul style="list-style-type: none"> - They actively try to access and share knowledge - They enhance knowledge creation and KS but are weak in knowledge application although they aim to innovate - They act as a knowledge hub and trigger on individual and company level - They actively use informal relations to enhance KS
RQ3: How do Keystones differ in more formal and more informal collaborative relationships?	<ul style="list-style-type: none"> - Keystones do not differ to a great extend in distinct CR they engage in - Most differences between Keystones could be related back to the industry environment they act in - The relations were shaped by the Keystone as well - Especially the existence of formal and informal relations had an impact on Keystone influence in CR

Table 9.1: Research questions and implications of this study

Additional to the main findings outlined above, this study shows that characteristics and actions of Keystones need to be rooted in an individual and company interest that have a strong personal and strategic intent. In order to have engaged Keystone individuals in CR, their interest as well as company interest need to be fulfilled. Actions and characteristics are aimed at reaching the personal and strategic interest on each level of interaction within their CR. Therefore, characteristics and actions of Keystones were not only aligned to reaching a certain strategy, such as business diversification in both cases, but could also be found repetitively on all levels of interaction. Nevertheless, the Keystone ability to reach the strategic aim set in order to gain knowledge for their new business area and diversify their business, could not be reached the same way on every level of

interaction. The ability to govern CR ceased with the decrease of interaction. Also, the more informal relations were necessary to address agents across other networks within the BE, in order to share and access the required knowledge, the more the importance of trust between network agents became visible. Altogether, characteristics and actions, their strategic relevance and Keystone strategy on network and BE level has been revealed, as well as the KS of the Keystone and its differences in distinct CR. Main difference between Keystones in distinct CR is the degree of influence on other agents in order to reach strategic aims. Informal relations resulted in less business relations but enabled a better KS due to a trustful relationship among partners. Still, informally shaped relations as in **Case II** showed to be more successful in addressing relations outside of network structures and acting as a knowledge hub on BE level. Governance mechanisms change, when CR change from formally influenced to less formally influenced relationships, and Keystone agents need to be able to use informal and formal governance mechanisms depending on the environment they are in.

9.3 Key contributions

In regards to theoretical contributions, the research conducted in this thesis contributes to theory by combining existing and long-standing concepts of SM with BE research. The study provides a good understanding of how the concepts can complement each other. Additionally, actions are outlined as foundation to strategy and are directly linked to strategy aims, contributing to the understanding of strategy as practise and the importance of individual action.

Referring to empirical contributions, the study is conducted as a multilevel approach, investigating the Keystone agent on individual and company while also considering his environment. This required a multimethod approach that is a novelty in BE and Keystone research. Network research is furthermore contributed to by a qualitative data analysis on network structures. By investigating the individual and its attributes in networks, the importance of the single firm was underlined. The individual agent as unit of analysis also offers a new perspective to network research.

Outlining Keystone role contributions, BE research is enriched by this work with a detailed understanding of Keystones and the actions and characteristics that describe them. Research supports and extends already outlined characteristics and adds strategy, position and links maintained by the Keystone to a structured role description. Additionally, a two level perspective on Keystones is provided, exploring not only the individual but also the company level. KS and KM activities are as well outlined referring to both level of analysis. Furthermore, research emphasises the interesting fact that Keystones do not differ greatly in distinct CR in terms of their characteristics and actions.

Discussing managerial implications, the study conducted can first of all support managers' understanding of network dynamics. They can use the birds-eye perspective on BE agents to understand their own role within CR and address their aim reach on different levels of interaction in a strategic way. This might also improve their decision making in CR. Due to case study analysis, this study provides a quite specific research background, which needs to be considered when managers apply findings revealed here. First of all, findings displayed are related to certain case background, and additional to that, the cultural background is influential. Germany is characterised by a less active and risk taking innovation culture, which also results in a different innovation culture within the networks. When taking the cultural and case specifics into account, managers may apply the findings in regard to the Keystone role. This study gives managers a comprehensive view on how competitive advantage can be sought for in CR following a certain strategy. Managers might also profit from the investigation of individual and company level interactions, understanding how individuals can be engaged to dedicatedly act for their company.

9.4 Limitations

Naturally, this research is also limited by the approach chosen and by research scope. For example is only one ecosystem role investigated, even though BE theory offers a variety of roles that interact with each other. For this study the role of the Keystone was selected, as it is the most influencing role within BE structures (Iansiti and Levien, 2004a) and an understanding of this role could also lead to

a better understanding of the whole system and its interrelations. Furthermore, research was mainly conducted in Germany, due to possibility of access and due to the innovation network funding scheme (VDE and VDI, 2016). Consequently, cultural aspects as well as governmental aspects might shape the cases investigated.

Only centralised network structures were investigated, and no stronger embedded structures. As distinct industries were selected and the description of the Keystone was aimed at, no completely different surroundings were chosen in order to ensure a certain generalisability among Keystones. Results are based on a multiple case study. Only two case studies were investigated, even though three cases were planned at the beginning. Due to a restricted access of case three and a lack of willingness to contribute, the third case was not investigated further. Even though, data saturation was already reached during the investigation of the second case, and cross-case analysis enabled a certain generalisability, the number of cases can increase validity of findings (Eisenhardt, 1989a). In this research the validity was then ensured by data and method triangulation, in order to ensure that findings were found repetitively by different methods and mentioned by distinct sources.

9.5 Future research

Results of this research indicate a number of future research opportunities. The study investigated the Keystone role in a structured way, using theoretical models and a theoretical framework in order to consider all Keystone specifics explored. Research could be extended by investigating the Niche player or the Dominator role in a similar way.

Furthermore, this research investigated the Keystone in different surroundings trying to verify his characteristics and actions as elements underlying his role description in more formal and more informal CR. Future research could add to this approach by investigating the Keystone in CR with even distinct structural features.

From a more detailed point of view, research suggests that Keystones balance their relationships with Niche players and Dominators. A deeper understanding of how exactly the relationships can be

balanced could be investigated further, laying a greater emphasis on relations and interdependencies between agents. This could also enable or more detailed understanding of the dynamics in CR.

The role of individual and company and its interrelation is stressed in this study but needs further investigation. For this reason more research underlying mechanisms is required.

Concluding the above, this thesis advances strategic management theory and practise by providing a detailed and structured description of the Keystone role in collaborative relationships, giving insights to its strategy, its position, its knowledge management and knowledge sharing activities.

10. References

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APPENDICES

APPENDIX A: Literature data collection process

Literature data collection process	Steps undertaken	Aim	Specific actions undertaken	Outcome of steps
<p>Structured literature data collecting process</p> <p>Adapting the process described by Denyer and Tranfield, 2011; Jesson Matheson, and Lavey, 2011; Galvan and Galvan, 2017; Hart, 2018</p>	<p>Step 1: structured research in two largest citation databases, SCOPUS and Web of Science (Mongeon and Paul-Hus, 2016)</p>	<p>Overview area of interest</p>	<p>Search of key articles around key words of title as being the identified areas of interest (Period: 1980-2017), older articles were considered when very relevant for understand the area of interest.</p> <p>Search for key words in title and abstract.</p> <p>Key words (solely and in combination):</p> <ul style="list-style-type: none"> - Knowledge sharing - Innovative strategies - Collaborative relationships - Open strategy 	<ul style="list-style-type: none"> - Identification of repetitive patterns around key areas of interest - Identification of BE as new area of research - Identification of key journals
	<p>Step 2: research in identified key journals plus research in two largest databases (SCOPUS and Web of Science)</p>	<p>Find main contributions to area of interest</p>	<p>The below journals were searched around the listed key words added by BE theory.</p> <p>(Period: 1980-2017), older articles were considered when very relevant for understand the area of interest.</p> <p>Search for key words in title and abstract.</p> <p>Key words:</p> <ul style="list-style-type: none"> - Business ecosystem (theory) <p>Plus adjacent concepts such as</p> <ul style="list-style-type: none"> - Collaborative relationships - Business network - Social network - Strategic alliances <p>JOURNALS</p> <ul style="list-style-type: none"> - Strategic Management Journal - Organization Science - Journal of Knowledge Management - Administrative Science Quarterly - Harvard Business Review - Academy of Management Review - Academy of Management Journal - Long Range Planning - American Journal of Sociology - Industrial Marketing Management - Management Science - California Management Review - Journal of Management Studies - Journal of Management - Sloan Management Review 	<ul style="list-style-type: none"> - Further identification of repetitive patterns around extended key areas of interest - Identification of Keystones as important agents in BE as new area of research - Identification of adjacent concepts around Keystones I CR/BES <p>883 contributions could be identified on term "business ecosystem"</p> <p>No platform ecosystem (technology background), innovation, industry or entrepreneurial ecosystems, digital ecosystems, customer centric business ecosystem, no crowdfunding platforms were considered.</p> <p>70 contributions could be identified referring to BEs in particular.</p> <p>Only contributions to BE theory were considered (n=70)</p>

			- Journal of Knowledge Management	
	Step 3: structured research on identified key words in two largest databases (SCOPUS and Web of Science)	Find literature around Keystones in BEs, also looking for adjacent concepts	<p>The literature search were narrowed towards a search around Keystones</p> <p>The following key words were searched for (Period: 1990-2017, as BE theory became relevant in the 1990)</p> <p>Search for key words in title and abstract.</p> <p>Added by key words used in the literature when Keystones are described:</p> <ul style="list-style-type: none"> - Keystone* - Orchestrator* - Platform+leader* - Ecosystem+regulator* - Ecosystem+leader* - Platform+strategy 	<p>387 contributions could be identified on key words</p> <p>160 contributions were referring to Keystones of any type (not necessarily related to BE)</p> <p>18 contributions referred to Keystones in BEs. (listed in Table 2.3)</p>

APPENDIX B: Information given to Research Participants (Research proposal)

Forschungsprojekt: Wissenstransfer in Netzwerken und Business Ecosystems
Anna Wulf



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Darstellung des Forschungsprojekts

Zu meiner Person

Im Rahmen meines Interesses an Netzwerken und Wissenstransfer zwischen Netzwerkpartnern auf Unternehmensebene habe ich im Jahr 2014 an der Plymouth University mein Doktorat aufgenommen. Zuvor erlangte ich ein Diplom in Betriebswirtschaftslehre an der Hochschule München und arbeitete 5 Jahre in der Industrie. Unter anderem war ich für ein Jahr in London tätig, daher auch meine Verbindung nach England. Zuletzt arbeitete ich für die AVIAREPS AG in München als Assistenz des Vorstandes. Hier lernte ich Unternehmensentscheidungen und ihre Einflussfaktoren kennen, was mein Interesse an Unternehmensstrategien in Netzwerken bestärkte.

Zum Thema

Seit ungefähr zwei Jahren arbeite ich nun am Thema Wissenstransfer in Netzwerken und beschäftige mich vor allem mit Rollen und Positionen in Netzwerken, die Wissenstransfer begünstigen oder behindern können. Vor allem die Umgebung des Netzwerks, sein finanzieller Aufbau, die Fortschrittlichkeit der Branche, die evolutionäre Stufe des Netzwerks interessieren mich als mögliche Einflussfaktoren. Zudem ist natürlich der Unternehmensaufbau der Akteure und deren Fähigkeiten und Interessen ein wichtiger Einflussfaktor zum Wissenstransfer. Mein Ziel ist es Netzwerke in ihrer Struktur zu verstehen und einzelne Rollen der Akteure heraus zu filtern. Das heißt abgeleitet auch zu verstehen wie Netzwerke erfolgreich sein können, wenn sie sich ihrer Rollen bewusst sind. Zusammengefasst bedeutet dies:

- Die Struktur des Netzwerks erkennen und die Einflussfaktoren benennen
- Rollen und Strategien und deren Einfluss auf den Wissenstransfer herausarbeiten
- Besondere Fähigkeiten einzelner Akteure zu analysieren

Es gibt in der Wissenschaft eine Theorie von Business Ökosystemen, die sich mit der Rolle einzelner Akteure in ihren Netzwerken beschäftigt. Diese Theorie schreibt bestimmten Akteuren bestimmte Fähigkeiten zu. Problematisch in der Praxis ist nur, dass sich viele Unternehmen ihrer Rolle nicht bewusst sind und ihre Potentiale innerhalb des Netzwerks nicht optimal ausnutzen können.

Ziel des Forschungsprojektes

„Die wachsende Bedeutung von Kooperation innerhalb [solcher] „business ecosystems“ liegt darin, das einzelne Unternehmen dem wachsenden Wettbewerbsdruck nicht mehr alleine standhalten können und in gewisser Hinsicht aufeinander angewiesen sind. Viele Unternehmen beginnen zu verstehen, dass sie ihr eigenes Ökosystem durch Kooperation mit ähnlichen oder verwandten Industrieunternehmen zum Vorteil aller Beteiligten stärken können, anstatt dieses durch Rivalität zu schwächen. Die Vorteile liegen dabei beispielsweise in der gemeinsamen Schaffung von engeren Kunden- und Lieferantenbeziehungen oder in der Zusammenarbeit z.B. bei der Schaffung von technischen Standards und bei gemeinsamen Forschungs- und Entwicklungsaktivitäten. Die Kooperation – sogar mit direkten Konkurrenten – vermag die Bedingungen für alle zu verbessern (Cohen, 2006).“

Cohen beschreibt eine gängige Vorgehensweise, die sehr stark dem Ansatz der Netzwerktheorie ähnelt. Der wesentliche Unterschied zur Netzwerktheorie besteht in der Identifikation von Rollen und

deren Aktivitäten in Netzwerken. Moore beschreibt diese Rollen in dem Buch „The Death of Competition (Moore, 1996)“. Nambisan und Sawhney beschreiben ebenfalls einzelne Rollen in Netzwerken oder Innovation Ecosystems und gehen darauf ein, welchen Einfluss die Umgebung des Netzwerkes auf die Rollen haben (Nambisan, Sawhney, 2007).

Vor allem wenn es um einen langfristigen Erfolg des Netzwerkes geht, und wenn Wissenstransfer ermöglicht werden soll, der innovative Vorgehensweisen ermöglicht, ist ein Bewusstsein über die Struktur des Netzwerkes, seine Akteure und seine Rollen notwendig (Iansiti, Levien, 2004a; Iansiti, Levien, 2004b).

Literatur

Cullen, J. (2006): Lernende Organisation. Verlag systemisches Management

Iansiti, M. and Levien, R. (2004a): Creating value in your business ecosystem, Harv. Bus. Rev, pp. 68–78.

Iansiti, M. and Levien, R. (2004b): Keystones and dominators: Framing operating and technology strategy in a business ecosystem, Harvard Business School, Boston.

Moore, J. (1996) The Death of Competition: Leadership and strategy in the age of business ecosystems., New York, HarperBusiness.

Sawhney, M. and Nambisan, S. (2007) The global brain: Your roadmap for innovating faster and smarter in a networked world, Pearson Prentice Hall.

APPENDIX C: Introductory letter for research participants

(Including ethics and data use)

Research Project: Knowledge sharing in organisational collaborative relationships:
the potential of open strategy- Anna Wulf



Research Project Information: Interview

Anna Wulf
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0152-31713195

Dear participant,

Thank you very much for taking part in this study to investigate knowledge sharing capabilities of certain of network roles by answering this semi-structured interview. You have been chosen to participate in this study due to your participation in the observation study or your knowledge in and first-hand experience of knowledge sharing and knowledge sharing processes within your company.

Research goal:

The aim of this semi-structured interview is to answer reach the following research goals:

- 1) Analyse how actors in business networks share knowledge and how openness of the network influences the knowledge shared between the partners.
- 2) Analyse the actors that play certain roles in networks in terms of their knowledge sharing capabilities
- 3) Investigate whether network openness and network structure influence that knowledge sharing capabilities.

What are you supposed to do?

- You will answer the research questions asked in the semi-structured interview
- The interview will take about 60-90 minutes
- The interview seeks to find answers to questions that raised during the observation process

Your rights:

- You have the right to have your questions about the next steps, procedure, etc. answered, unless answering the questions would interfere with the study's outcome. Please feel free to contact me at any time; my contact information can be found at the top of this page.
- You may decide to stop being a part of this study at any time with no reason given. Your personal information will be deleted immediately.
- You have the right to omit or refuse to answer or respond to any question.
- Throughout the research process, you will remain anonymous. I may use direct quotes, but these comments will not be linked to your name. I will keep your personal information strictly confidential.

Your risks and benefits from participating in the study:

- There are no known risks for you as a participant.
- After finalising the research you will get an birds eye perspective on the dynamics of the network your company is acting in due to the knowledge you personally contributed

APPENDIX D: Example network mapping form

Example of network mapping form given to all Research participants of the case study

Netzwerkkarten Abfrage/ Anna Wulf/ Plymouth University

Your name:

You need the network in order to reach your company goals or targets?

Yes ☐

No ☐

The network is important to align your company strategy to upcoming events?

Yes ☐

No ☐

Are you active in other business networks as well?

Yes ☐

No ☐

Can you identify someone to be a triggering person of the network (someone who keeps the network active and alive)?

Yes ☐

No ☐

Can you name the person?

Previous Tie Script

All names of network participants are mentioned in the left and column. Please only cross the characteristics that fit exactly to the person you are describing.

Name of other network members	I knew person before the network started	Relation is mainly build on contract we had or business we made together	Relation is mainly build on many meetings and conversations we had	Relation is mainly build on a friendship	The person is part of the founders of the network	We have very often contact	We have seldomly contact	I often receive information or help if I ask for it	The person is well connected to other networks

APPENDIX E: Primary and Secondary Data Index

Primary and Secondary Data Index of **Case I** and **II**

Table 1: Primary and Secondary Data Index of **Case I**

Subject area	Data	Case one
Industry data	Secondary data	Industry data (secondary data) (SP is a weekly journal about politics, economics and culture) Source, Date (Reference) - SP1, 21.01.2017 (S1, 2017) - SP2, 24.01.2017 (S2, 2017) - SP3, 25.07.2017 S3, 2017) - SP4, 29.07.2017 (S4, 2017) - SP5, 05.08.2017 (S5, 2017) - Region for Innovation, 2016 (R1, 2016) (Regional value creation report) - Campushunter, 2016 (Career Magazine) (C1, 2016)
Network data	Observations (10 observations of network meetings)	Source, Date (Reference) - network observation I-IX, 2016 (NOI-X) Plus network mapping sheets - Sheet Company B (NMP_Company C_2016) - Sheet Company C (NMP_Company C_2016)
Network data	Secondary data	Source, Date (Reference) - Document 1_2016 (ND1, 2016) - Document 2_2016 (ND2, 2016) - Document 3_2016 (ND3, 2016) - Document 4_2016 (ND4, 2016) - Document 5_2015(ND5, 2015) - Document 6_2016 (ND6, 2016) - Document 7_2017 (ND7, 2017)
Company A-	Interviews	- Company A, Interview I (A1)
	Secondary data	- Document 1_2016 (AD1, 2016) - Document 2_2016 (AD2, 2016) - Document 3_2014 (AD3, 2014) - Document 4_2016 (AD4, 2016) - Document 5_2015 (AD5, 2015) - Document 6_2013 (AD6, 2013) - Document 7_2014 (AD7, 2014)
Company B:	Interviews	- Company B, Interview I (Keystone person) (B1) - Company B, Interview II (Keystone person) (B2) - Company B, Interview III (Keystone company employee) (B3) - Company B_Interview IV (Keystone person) (B4)
	Secondary data	- Company B_Document 1, 2016 (BD1, 2016) - Company B_Document 2, 2016 (BD2, 2016) - Company B_Document 3, 2016 (BD3, 2016)

Company C:	Interviews	<ul style="list-style-type: none"> - Company C, Interview I (Keystone person) (C1) - Company C, Interview II (Keystone person) (C2) - Company C, Interview II (Keystone employee) (C3)
	Secondary data	<ul style="list-style-type: none"> - Document 1_2008 (CD1, 2008) - Document 2_2017 (CD2, 2017) - Document 3_2017 (CD3, 2017) - Document 4_2016 (CD4, 2016) - Document 5_2016 (CD5, 2016) - Document 6_2016 (CD6, 2016)
Company D: (Niche Player)	Interview	- Company D, Interview I (D1)
Company E (Niche Player)	Interview	- Company E, Interview I (E1)
Governmental institution	Interview	- Governmental institution, Interview I (F1)

Table 2: Primary and Secondary Data Index of Case II

Subject area	Data	Case two
Industry data	Secondary data	<ul style="list-style-type: none"> - Industry document_1_2017 (ID1, 2017) - Industry document_2_2017 (ID2, 2017) - Industry document_3_2014_(ID3, 2014) - Industry document_4_2017_(ID4, 2017) - Industry document_5_1995_(ID5, 1995)
Network data SIN	Observations	- network observation I-V, 2016 (NNOI-V)
	Secondary data	<ul style="list-style-type: none"> - NND1, 2015 - NND2, 2017 - NND3, 2015 - NND4, 2015 - NND5, 2016 - NND6, 2016
Company A-	Interviews	<ul style="list-style-type: none"> - Company A, Interview I, employee (AA1) - Company A, Interview II, employee (AA2) - Company A, Interview III, employee (AA3) - Company A, Interview IV, employee (AA4) - Company A, Interview V, employee (AA5) - Company A, Interview VI, company head (AA6) - Company A, Interview VII, employee (AA7) - Company A, Interview VIII, employee (AA8) - Company A, Interview IX, employee (AA9) - Company A, Interview X, company head (AA10) - Company A, Interview XI, employee (AA11) - Company A, Interview XII, employee (AA12) - Company A, Interview XIII, employee (AA13) - Company A, Interview XIV, company head (AA14) - Company A, Interview XV, company head (AA15)
	Observations	<ul style="list-style-type: none"> - Company A meeting observation I-V, 2016 - AOI - AOII - AOIII - AOIV - AOV
	Secondary data	<ul style="list-style-type: none"> - Company A_Document_1_2011_(AAD1, 2011) - Company A_document_2_2011 (AAD2, 2011) - Company A_Document_3_2011 (AAD3, 2011) - Company A_Document_4_2008 (AAD4, 2008) - Company A_document_5_2017 (AAD5, 2017) - Company A_document_6_2016 (AAD6, 2016) - Company A, Document_7_2017 (AAD7, 2017) - Company A_Document_8_2008 (AAD8, 2008) - Company A_Document_9_2016 (AAD9, 2016) - Company A_Document_10_2017 (AAD10, 2017) - Company A_Document_11_2016 (AAD11, 2016) - Company A_Document_12_2016 (AAD12, 2016)

		- Company A_Document_13_2016 (AAD13, 2016)
Institution B:	Interviews	- Company B, Interview I (IB1)
	Secondary data	- Institution_B_Document_1_2011 (IBD1, 2011) - Institution_B_Document_2_2016 (IBD2, 2016) - Institution_B_Document_3_2017_(IBD3, 2017) - Institution_B_Document_4_2016_(IBD4, 2016) - Institution_B_Document_5_2016_(IBD5, 2016) - Institution_B_Document_6_2017_(IBD5, 2017)
Company C:	Secondary Data	- Document_1_2016 (CCD1, 2016) - Document_2_2017_(CCD2, 2017) - Document_3_2016_(CCD3, 2016) - Document_4_2016_(CCD4, 2016)
Company D	Interview	- Company D, Interview I (D1)

APPENDIX F: Summarised characteristics of Case I and Case II

Figure 1: Characteristics of **Case I**

Dimensions from Literature review		Description Case I	Processual and content dimension (relevant for all levels)
Description of Business ecosystem (Structural entity shaped by network relations)		Business ecosystem as economic force field around digitalisation influenced by competitive and dominating industry high economic dependency other industries that could contribute to business ecosystem of digitalisation are underdeveloped big changes due to impact of digitalisation in dominating industry high velocity environment with homogeneous actors	<p>No innovative ideas that could create competitive advantage and meet future developments</p> <p>very restricted knowledge sharing of relevant knowledge or know how</p> <p>knowledge no shared openly but on different level of interaction</p> <p>lack of variety of knowledge sharing partners leads to little value creation</p> <p>high specialisation of network agents, not enough interaction between them</p> <p>strong communication rules and rules of interaction</p>
Structural dimension		little structural variety scattered not cross connected relevant industries mainly closed and formal structures	
Relational dimension		mainly business relations, formal relations mainly competitive relations or cooperative relations	
context dimension (e.g. cultural dimension)		no collaborative exchange culture	
Description of network investigated (Structural entity shaped by network relations)		big player in business ecosystem also influences relations in network still influence of economic dependency although network aim focusses on cross industry developments network development and network management shaped by core group connection of core group to big player remains unclear uncertainty, proximity and dependency shape network	
Network level	Structural dimension	closed network structures with open events for network development access for companies that can bring in variety and innovative ideas sparse network structures with big potential for cross connections very structured and influenced by economic dependency in supply chain close network cohesion due to formal rules of interaction	
		regular interaction due to formal rules of frequent direct interaction (meetings)	
		formal business relations overlap the development of informal interaction strong hierarchical network governance mechanisms attempt to enhance informal relations but business relations create dependency	
		strong rules of participation mostly dyadic ties strong business ties that shape network entity but not beyond	
	Relational dimension	Keystones act as bridges to other networks in region, industry or business ecosystem of digitalisation cooperative or competitive relationships cooperative or competitive exchange culture	
		closed network culture	
		Keystone Companies shaped by adaptability at flexibility , big player and other agents are slowly adapting to changes. This again influences Keystone Company structural inertia of supply chain dependency influences Keystone Company proximity to main business partners Company structures are shaped by lean structures and less hierarchies	
		mechanistic and organic at the same time depending on new or traditional business unit and size of Keystone Company openness in regards to new business (unit/area) development	
	context dimension (e.g. cultural dimension)	internal patterns of behaviour rather than prescribed positions . Responsibility of employee to work on tasks bureaucratic process shaped by supply chain dependency of traditional business (unit). New business (unit/area) shaped by informal connections and processes in company as not set by repetitive behaviour or routines. depending on business (unit/area) more competitive or collaborative relations Keystone person in network core as network trigger due to his informal contacts in region or in specified area, Keystone Company certain influence due to proximity to big player	
		knowledge exploration of new knowledge rather than knowledge exploitation. No process development or routine development of actions. Not learning organisation. collaborative and competitive depending on business (unit/area) No information of other employees than Keystone person (Keystone person entrains employees to his ideas) due to direct contact of Keystone person to relevant people inside and outside the company related to his aim	
Individual level (personal level)	Structural dimension	Individual connects via personal social network and informal relations in sparse and embedded organisation structure to reach his aim	
	Relational dimension		
	context dimension (e.g. cultural dimension)	Familiar and open exchange culture in company or business unit that enhance personal engagement. Willingness to share knowledge on specific subject of digitalisation among employees. Direct communication important to keep personal social network in company.	

Figure 2: Characteristics of Case II

Dimensions from Literature review		Description Case II	Processual and content dimension (relevant for all levels)
Description of Business ecosystem (Structural entity shaped by network relations)		Business ecosystem as force field for innovation development in sports influenced by a hierarchical and competitive elite sports industry collaborative industry culture due to team mentality and informal relations used to overcome structural inertia in industry continuous development but big changes due to digitalisation expected in the near future heterogeneous interconnected actors of different relating industries that are involved into sports industry	<p>Innovative ideas are developed among heterogeneous actors but no one fosters further development or innovation implementation</p> <p>lack of innovation implementation leads to little value creation</p> <p>contacts outside of network are used to bring new knowledge in and knowledge is shared openly but often not used</p> <p>if innovative ideas are fostered towards the stage of developing a prototype depends on interest of Keystone person or network core</p> <p>knowledge created in network is used to develop relations outside of network in order to build up a bigger network entity around innovation in sports</p>
Structural dimension		high structural variety scattered industry but also existing cross connections of different industries closed and open structures depending on elite or leisure sports industry	
Relational dimension		shaped by business and informal relations as well as friendships collaborative, competitive and cooperative relations	
context dimension (e.g. cultural)		collaborative exchange culture	
Description of network investigated (Structural entity shaped by network relations)		no single big player in business ecosystem that influences relations in network network (as structural entity) and company as basis for business ecosystem developments network management conducted by one company of core group, network development shaped by core group all agents bring in their contacts but are not very embedded in network trust, cohesion, informal relations shape network	
Network level	Structural dimension	closed network structures for network entity as network membership is required due to business model of network management. Access for personalities that fit into network . Open informal structure around network core as they are open to innovative ideas	
		sparse network structures due to central network management. Works on more embedded structures to reduce resource invest	
		structured and unstructured as activity constantly changing	
		loose network cohesion due to informal rules of interaction	
	Relational dimension	regular interaction due to development of new ideas, mutual interest and joint goals that adapt to new possibilities	
		informal relations overlap the development of business relations	
		social network governance , no hierarchies to push or influence interests	
		informal relations enable loose connection and free sharing of ideas but hinder business relations	
	context dimension (e.g. cultural)	less strong rules of participation mostly dyadic ties accept network core strong and weak ties in network entity and beyond Keystones act as bridges to other networks in industry collaborative, cooperative or competitive relationships	
		collaborative exchange culture open network culture	
Company level	Structural dimension	Due to constant change of innovation subjects, company used to adapt to changing environments and often shapes changes itself flexible company, no clear structure , no clear responsibilities, high employee responsibility	
		organic organisation shaped by constant adaption and change with no clear structures and processes	
		open company boundaries , company strategy shared to other network agents	
	Relational dimension	internal patterns of behaviour rather than prescribed positions . Responsibility of employee to work on tasks	
		informal connections and processes very little routine	
		collaborative relations in company	
	context dimension (e.g. cultural dimension)	Keystone person in network core as network trigger due to his informal contacts in industry (especially political contacts)	
		knowledge exploration of new knowledge rather than knowledge exploitation. No process development or routine development of actions. Not learning organisation	
Individual level (personal level)	Structural dimension	collaborative company culture reward system for employees but no information system, processes or clear leadership. Employees have to take over responsibilities of company in order to fill their tasks	
		individual connects via personal social network and informal relations in sparse and embedded organisation structure to reach his aim	
	context dimension (e.g. cultural dimension)	informal relations and open exchange culture enhance personal engagement also of Keystone Company employees. Willingness to share knowledge openly. Direct communication important but due to importance of Keystone person for the company's informal network Keystone company employees are not always included in communication.	

APPENDIX G: Topic guide in-depth open interviews

Figure 3: Topic guide developed for in-depth open interviews (own figure)

Topic Guide		
Topic theme	Topic details	Adressed interviewee
Network and business ecosystem structure	<ul style="list-style-type: none"> - Understanding of network and business ecosystem structure 	<ul style="list-style-type: none"> - Keystone person
Network development	<ul style="list-style-type: none"> - Overall development - Who was engaged and triggering development? - How was development engaged and triggered? For what reason? - Own role in development in network 	<ul style="list-style-type: none"> - Keystone person - Employees Keystone company - Other network members
Influence in network	<ul style="list-style-type: none"> - Influential members - How is network influenced - Types of relations that influence 	<ul style="list-style-type: none"> - Keystone person - Other network members
Network members	<ul style="list-style-type: none"> - Network member characteristics 	<ul style="list-style-type: none"> - Keystone person - Employees Keystone company - Other network members
Own roles	<ul style="list-style-type: none"> - Description of own characteristics/ Keystone characteristics 	<ul style="list-style-type: none"> - Keystone person - Employees Keystone company - Other network members